Tyson's Site
Montgomery County, Pennsylvania

Off-Site Operable Unit Remedial Investigation Report

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Appendices

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APPENDIX R

ACADEMY OF NATURAL SCIENCES
FINAL REPORT

Tyson Dump Sediment Leachate Bioassays with *Daphnia magna* and *Pimephales promelas*

prepared for

Environmental Resources Management

by

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Sediment Sampling/Bioassay

Three large volume composite sediment samples were collected for use in the acute and chronic bioassay studies that were conducted by the Academy of Natural Sciences of Philadelphia (Academy). The Academy's Bioassay Laboratory performed eight definitive bioassays on the three leachate samples and on a reference toxicant obtained from EPA. The reference toxicant was tested to determine if animals used in the tests were healthy and test conditions conformed with appropriate physical and chemical conditions required by the test animals. For each leachate, the Academy ran a 21-day continuous flow chronic test with Daphnia magna, conforming to guidelines published by the Environmental Protection Agency in The Federal Register (40 CFR, Paragraph 797.1330, "Daphnid chronic toxicity test."), and a definitive 7-day growth test with larvae of the fathead minnow Pimephales promelas, conforming to guidelines published in EPA/600/4-85/014. Because of the volatile nature of the compounds present at the site, the fish chronic tests also had to be performed by continuous flow rather that static renewal. Guidelines for the continuous flow conditions with fish followed The Federal Register (40 CFR, Paragraph 797.1600 "Fish early life stage toxicity test."), but in all other aspects the fish test conditions conformed with the test protocol of EPA/600/4-85/014. The response of animals to the reference toxicant was tested by a 48-hour acute Daphnia

test, and a 96-hour test of *Pimephales* larvae growth. Both were static renewal tests.

METHODS

Sample Collection

The three sediment samples collected included one background composite sample, designated as the BG sample, from west of the site, one composite sample from the western swamp area, designated as the WS sample, and one composite sample from the air stripper outfall ditch, designated as the AS sample. These locations are shown on Plate __. Soils used to generate the leachate were collected in two phases because large soil volumes were required and the Academy could only operate two continuous flow tests at a time. During the first phase of sampling, a large composite sample from the west side of the Background Site was collected for leachate generation, along with two small grab samples which were analyzed to provide chemical data for the next two bioassay tests. A subsample of the composite background sample was also taken for chemical analysis. In the second phase, two composite samples were collected, one from the Air Stripper outfall, and one from the West Swamp. Each of the three composite soil samples was collected by shovel, put into a 16 quart stainless steel bucket, thoroughly mixed, and transferred to 55-gallon stainless steel drums. Four full buckets accounted for the entire sample aliquot. Samples were immediately driven by an ERM geologist to the Academy in Philadelphia, Pennsylvania.

The reference toxicant, sodium lauryl sulfate, was obtained from EPA's Environmental Monitoring and Support Laboratory, (Cincinnati, Ohio),

The background leachate and reference toxicant supplied by EPA were tested first. The second phase consisted of tests conducted from leachates generated from the composite samples taken at the air stripper outfall and western swamp.

Dilution Water

Dilution water was collected from Round Valley Reservoir, a pump-storage, oligotrophic reservoir located in central New Jersey. The dilution water was chemically analyzed for pH, alkalinity, hardness, metals and pesticides. Dilution water was filtered and autoclaved prior to the Daphnia tests but not for the fish larvae test. Autoclaving prevented the introduction of other invertebrates that might be predators of Daphnia, or of additional daphniids that live in the Reservoir.

Leachate Preparation.

The leachates were generated using the "Standard Test Method for Shake Extraction of Solid Waste with Water"; ASTM: D 3987 - 85. Soil samples were weighed and added to dilution water at a ratio of one part sediment to 20 parts water (175 gms sediment to 3500 mls of water). The samples were agitated for 18 h in a motorized, rotating agitator constructed following recommendations of the above ASTM guideline. The agitator was maintained at 29 r/min. After agitation, the samples were allowed to settle for 10 minutes

and then decanted through a screen to remove large particles such as roots, sticks, or pebbles. The leachate was then separated from the sediment by continuous flow centrifugation. We initially attempted to filter the samples rather than centrifuge them, but the filters immediately clogged. After centrifugation, the leachate was stored overnight in the test room to bring the water to the test temperature, and was then immediately used in the bioassay.

Bioassays.

Standard protocols (referenced above) were used for each test. Quality assurance/quality control procedures, as directed by each protocol, were followed. Only new or disposable glassware and chambers were used for these tests, all glassware was acid-washed, rinsed with acetone, washed with a laboratory non-detergent cleanser, and rinsed several times with a very pure laboratory water obtained by passing distilled water through two deionizing cartridges and one carbon cartridge (Millepore's Milli-Q system) prior to use. All test instruments, i.e., thermometer, dissolved oxygen meter, pH meter, conductivity meter, and balances were calibrated prior to use. Alkalinity and hardness tests followed protocols published in Standard Methods For the Examination of Water and Wastewater, 13th Edition (ANON, 1971).

Room temperature during the Daphnia tests was maintained at 20±2°C, and during the fish test at 25±2°C. The photoperiod for all tests was 16 h light 8 h dark.

During each test, water in all beakers were tested each day for temperature, and flow rates were calibrated. Dissolved oxygen, alkalinity, pH, hardness, and conductivity were measured once each week. These analyses were performed on one replicate beaker for on all test concentrations waters in the *Daphnia* test and on the control and 100% leachate beakers for the fish, as required by the appropriate protocols.

For the *Daphnia* test, twenty individuals less than 24-h old, were tested at each of five leachate concentrations (diluted with the control water), and a dilution water control. The 20 individuals were divided among two 600-ml borosilicate beakers, each containing 500 ml of dilution water and/or leachate. Five to six changes of test water occurred each day in each beaker. Continuously operating pumps (Manostat) delivered water from reservoirs containing test water and food. The test water was delivered to splitter flasks (Ace Glassware Inc.), which then divided the test water into each of the replicate beakers. The food consisted of the green alga *Ankistrodesmus falcatus*, added to the test water at a concentration of 1.25 mg as Carbon per liter. Deaths of adults and juveniles, and number of live and dead offspring were determined for each vessel on Monday, Wednesday and Friday of each week.

For the *Pimephales* test, newly born minnows were obtained either from Kurtz Fish Hatchery, Elverson, PA., or from the Alabama State Fish Hatchery, Merion, AL. The test

chambers consisted of 600-ml beakers, with 10 larvae in each beaker. Two replicate beakers were maintained for each test concentration. Animals were fed three times a day, with brine shrimp nauplii that had been cultured in the Academy's fish laboratory. The *Artemia* eggs were purchased from Aquarium Products, Glen Burnie, Md. (Lot No. 190). We found that the heavy food amounts suggested by the EPA protocol caused a heavy growth of fungus in the flasks. The fungus affected fish survival during the tests with the Background sediment sample. After this test, we reduced the amount of *Artemia* provided as food, and changed beakers every other day throughout the test. We had no further problems with premature fish deaths. After seven days, living individuals from each test concentration, and the dilution water control were measured (total length), dried at 60°C for 24 h, and then weighed on a calibrated Mettler Balance sensitive to 0.001 mg (Model AE 163).

Data Analysis.

The trimmed Spearman-Karber and the probit models were used to estimate acute toxicity of the leachates. An analysis of variance (ANOVA) was used to determine the effect of concentration of leachate which causes a significant difference from the control of each of the following life history parameters: survivorship, growth as measured by increase in length and weight for fish, and average number of young produced per female per 21-day test period for *Daphnia*. The T-Method (Sokal and Rolf 1981) was used to identify a no-

effect concentration (NOEC), the lowest concentration that produced an effect (LOEC), and a maximum allowable toxicity concentration (MATC), calculated as the geometric mean of NOEC and LOEC estimates. This test was used, rather than Dunnett's Many-t method because the latter test only permits a comparison between a test concentration and the control, and not among different concentrations for significant effects.

RESULTS

Physical and Chemical Conditions During Leachate Tests.

Physical and chemical analyses of the water prior to and during the tests are summarized in Table I.-A-B. for the *Daphnia* tests, and in Table II.-A-D. for the fish tests. Flow rate measurements and sediment weights for all tests are summarized in Table III and Table IV respectively. Test conditions were maintained as close to those specified in the protocols as possible. The average test temperatures for each *Daphnia* test ranged, in degrees Celsius, for the SLS test from 19.6 to 20.4, the BG test from 18.4 to 20.6, in the AS test from 18.6 to 19.9, and for the WS test, 19.0. For the fish tests, average temperatures for each test vessel for the SLS test ranged from 23.3 to 23.7 ^{o} C, BG was consistently at 22.9 ^{o} C, AS was 23.2 to 24.3 ^{o} C, and WS from 22 to 22.8 ^{o} C. Oxygen values were maintained at or near to saturation in all test chambers during all tests without artificial aeration (Tables 1 and 2). Conductivity and pH did not deviate significantly from the control vessels

with dilution water, however pH values for the Daphnia AS and WS leachate tests were low, and possibly could stress these animals (Tables I and II). Alkalinity and water hardness decreased with increasing leachate concentration in the same leachate tests. To insure five complete changes of the test water in the vessels each day flow rates had to be at least 3.47 mls/minute. Flowrates never fell below this value during any of the tests (Table IV.).

Daphnia Magna Acute and Chronic Test Results.

Background Site.

The results of the Daphnia chronic tests are presented in Table V and VI. A preliminary 48-hour screen test with daphniids, using death and body weight as the assay of the effect of the BG (Background) leachate indicated no acute or chronic toxicity effect on Daphnia for either 50% or 100% leachate concentrations. Therefore, for the definitive 21-day daphniid test we selected 100%, 90%, 80%, 70%, and 60% as the test concentrations.

Deaths occurred in all test concentrations, without a monotonically increasing trend between 60 and 100%. An LC 50 acute toxicity value was calculated but the 95% confidence limits were too large to suggest a good estimate. A statistically significant chronic effect on reproduction by the BG leachate was found at all leachate concentrations, by ANOVA and the T-Method (Sokal and Rolf 1981). All vessels receiving the BG leachate had a substantial build-up of silt and clay which very likely had an effect on the daphniids ability

to feed. The impact of turbidity as an interference during the test will be discussed later in this report.

Air Stripper Sediments.

Because of time constraints, a screen test could not be performed prior to the tests with the AS (Air Stripper) or WS (West Swamp) leachate tests with daphniids. The same concentrations of leachate as used with the background sample were used for both tests. A 21-day LC 50 acute toxicity was calculated to be 74% of the leachate by the Spearman-Karber model (Table VI.). The estimates from the Probit model were virtually identical and therefore are not reported. Calculations of a 6-day and a 14-day LC 50 could not be made.

The chronic test results, using average offspring produced per female in 21 days, indicated a significant test effect at all concentrations of the AS leachate, from 60% to 100%. 70%, 80%, and 90% leachate concentrations had a greater effect than 60%; 80 and 90% leachate were not significantly different from 70%, but 100% leachate was significantly different from the impact of the 70% leachate concentration. The lowest effect concentration for chronic toxicity (LOEC) is at or below 60% leachate concentration.

The leachates from the AS sediments were not as turbid as those from the BG site and turbidity did not appear to have an effect on the daphniids. The results of both the acute and chronic data, indicating a 21-day acute and a monotonically increasing chronic effect on daphniids, indicates that the sediments collected near the Air Stripper has both an acute and chronic toxicity to daphniids.

Western Swamp.

The 21-Day acute LC-50 concentration for the WS leachate was 69.6%, indicating that this leachate is acutely toxic to daphniids. Reproduction by daphniids was affected by the leachate at 60% concentration or below. As with the AS leachate, a gradual increase in effect occurred at higher concentrations; the effect at 90 and 100% leachate concentrations were significantly greater than the effect at 60%.

Reference Toxicant.

The reference toxicant was Sodium Lauryl Sulfate (SLS). Tests performed by the Environmental Protection Agency indicate that an LC 50 (that test concentration estimated to immobilize or kill 50% of the animals within 48 hours) for healthy daphniids should range from 7.3 to 13.3 mg/L of SLS. The LC 50 for daphniids maintained in the Academy's test laboratory was 7.9 ppm (Table VI). We conclude that the daphniids used in the leachate tests were healthy animals.

7-Day Fish Larvae Acute and Chronic Test Results.

The 7-day fish larvae growth test is a newly developed test (Norberg and Mount 1985). Problems with the protocol exist that appear to have affected fish survival during this study.

Background Site.

Survivorship of fish larvae was affected in all vessels, including the control vessels, during this test. The protocol recommended a heavy feeding of *Artemia* to the fish, and

no transferral of larvae to new beakers during the test. We found a significant build-up of fungus in all beakers, including the control beakers, during this test that had a negative effect upon the fish, resulting in a high proportion of deaths (Table VIII A.). Since this impact occurred in both the control vessels and the leachate vessels, we believe the impact was due to factors other than the leachate. In subsequent tests, less food was added to the test vessels, and the exposure vessels were replaced with clean vessels every other day. Fish larvae during the subsequent leachate tests had much better survivorship. The high turbidity that affected the daphniids during the BG test did not appear to affect the fish larvae.

An acute toxicity or chronic effects on growth of fish larvae, as compared with the survivorship and growth of fish larvae maintained in the dilution water control could not be detected as a result of exposure to the BG leachate.

Air Stripper.

The concentrations of AS leachate used were as follows: 100%, 90%, 80%, 70%, and 60%. Survival of fish larvae in the control vessels exceeded 80% during this 7-day test, as required by the protocol (Table VII B).

An acute toxicity (LC 50), as measured by the Spearman-Karber or Probit models could not be calculated because no concentration of leachate killed more than 50% of the test animals.

The body lengths and body mass estimates of larvae

exposed to the different leachate concentrations were not significantly different from those of the larvae exposed only to the dilution water control during the 7-day test. Therefore, the leachate from the sediment near the Air Stripper did not have an acute or a chronic impact on fathead minnow larvae.

Western Swamp.

The same test concentrations with leachate as used previously were used during the test with the WS sediments. Survival of fish larvae in the dilution water control again exceeded 80% during this 7-day test, as required by protocol (Table VII C.). Greater death rates occurred in the vessels containing the graded series of leachate concentrations, but none exceeded 50% deaths of larvae. Therefore, an LC 50 value could not be calculated.

The body lengths and body mass estimates of larvae exposed to all concentrations of the WS leachate was not significantly different from those for the larvae in the dilution water control vessels, indicating no chronic toxicity on the fish larvae.

No acute or chronic toxicity was detected for fish larvae exposed to the West Swamp sediment leachates.

Reference Toxicant.

The reference toxicant used was Sodium Lauryl Sulfate, obtained from the EPA Support Laboratory. We exposed the larvae to a low concentration series (0.1 to 1.0 mg/L) in order to obtain chronic test effect on fish larvae growth. No negative impact on the fish larvae was measured at any of

the concentrations used (Table VIII D.). This could certainly imply that these broods of fish larvae were healthy for subsequent useage, based on known acute toxicity levels of SLS to young fish. However, we have not been able to find corresponding data on the chronic toxicity of SLS to make this comparison.

DISCUSSION OF RESULTS

The inability to separate the silts and clays from the leachate by filtration complicated the initiation of these tests. Continuous flow centrifugation was used instead, but this procedure required some development time. All sediments could not be removed from the leachate, but residual sediment only appeared to interfere with the daphniids during the BG leachate test, and did not have an effect on the fish larvae. The leachates obtained from both the AS or WS sediments were not as turbid, and did not appear to interfere with the daphniids. The difference in residual turbidity among the three leachates may have resulted from a different particle composition in the latter two sediment samples. Alternatively, the difference in turbidity could have resulted from lower amounts of silts and clays present in the more moist sediments collected from the AS and WS sites. The BG sediment was quite dry; whereas, the AS and WS sediments had a high proportion of water. Though the same ratio of sediment mass to water mass was used to generate the leachates for all tests, much more silt and clay would have been present in the BG sediments. The turbidity present in the BG leachate

appeared to interfere with feeding by the daphniids by clogging their feeding limbs.

The results from the test with leachate generated from the composite sediment sample collected near the Air Stripper and the West Swamp produced both an acute and a chronic effect on daphniids during the 21-day test period. The trend of increasing effect on daphniid reproduction at higher concentrations of leachate, as determined by ANOVA and the T-method comparison of values for each concentration, indicates that these sediments contains toxicants that affect both survival and reproduction in daphniids when they are exposed for 21 days.

In contrast to the daphniid tests, no acute or chronic toxicity impact was detectable on survival or growth of fathead minnow larvae during the 7-day period. It is not unusual to find toxicity to daphniids but no effect on adult fish. Because little information is available for the 7-day fish larvae test, we cannot conclude that fish larvae are less sensitive than daphniids.

Table I.A. Background Sample: Water chemistry data for 21-day *Daphnia* bioassay.

	Control		6%		7%		8%		9%		10%	
	A	B	A	B	A	B	A	B	A	B	A	B
Dissolved Oxygen (ppm)												
X	8.50	–	8.08	–	7.94	–	7.88	–	7.85	–	7.81	–
S.D.	0.28	–	0.26	–	0.23	–	0.29	–	0.31	–	0.48	–
Range	8.2-8.6	–	7.7-8.3	–	7.7-8.2	–	7.5-8.1	–	7.4-8.1	–	7.1-8.2	–
pH												
X	6.47	–	6.35	–	6.35	–	6.38	–	6.33	–	6.33	–
S.D.	0.15	–	0.25	–	0.17	–	0.14	–	0.18	–	0.18	–
Range	6.3-6.6	–	6.0-6.4	–	6.1-6.5	–	6.1-6.4	–	6.2-6.4	–	6.2-6.4	–
Temperature (°C)												
X	19.15	–	19.16	–	19.14	–	19.15	–	19.18	–	19.25	–
S.D.	0.48	–	0.43	–	0.47	–	0.47	–	0.48	–	0.53	–
Range	18.6-20.2	–	18.7-20.2	–	18.4-20.2	–	18.4-20.2	–	18.4-20.6	–	18.4-20.2	–
Conductivity (umho)												
X	127.00	–	131.00	–	131.67	–	132.33	–	132.33	–	133.33	–
S.D.	1.73	–	3.61	–	3.51	–	2.52	–	2.52	–	4.16	–
Range	125-128	–	128-135	–	128-135	–	130-135	–	130-135	–	130-138	–
Alkalinity (ppm)												
X	41.50	–	41.50	–	40.00	–	38.75	–	39.00	–	36.5	–
S.D.	1.00	–	4.73	–	3.27	–	2.50	–	2.58	–	4.12	–
Range	40-42	–	38-48	–	36-44	–	36-42	–	36-42	–	32-42	–
Hardness (ppm)												
X	52.50	–	57.50	–	53.50	–	53.50	–	53.50	–	55.25	–
S.D.	1.00	–	5.97	–	7.55	–	5.51	–	7.72	–	6.40	–
Range	52-54	–	52-66	–	48-64	–	48-60	–	46-64	–	50-64	–

Table I.B. Airstripper: Water Chemistry data for 21-day *Daphnia* bioassay.

	Control		60%		70%		80%		90%		100%	
	A	B	A	B	A	B	A	B	A	B	A	B
Dissolved Oxygen (ppm)												
X	8.9	-	8.43	-	8.20	-	8.05	-	7.93	-	7.8	-
S.D.	0.35	-	0.35	-	0.43	-	0.48	-	0.58	-	0.57	-
Range	8.4-9.2	-	-	-	7.8-8.8	-	8.6-8.7	-	7.3-8.7	-	87.1-8.5	-
pH												
X	5.38	-	5.38	-	5.40	-	5.40	-	5.45	-	5.40	-
S.D.	0.46	-	0.36	-	0.36	-	0.38	-	0.35	-	0.41	-
Range	4.7-5.7	-	4.9-5.7	-	5.0-5.8	-	5.0-5.8	-	5.1-5.8	-	5.0-5.8	-
Temperature (°C)												
X	18.94	19.98	18.99	18.99	18.99	18.99	18.99	19.98	18.99	18.97	19.02	18.99
S.D.	0.23	0.29	0.31	0.29	0.29	0.28	0.38	0.29	0.29	0.30	0.29	0.29
Range	18.8-19.9	18.6-19.8	18.6-19.9	18.7-19.8	18.8-19.9	18.8-19.8	18.8-19.9	18.6-19.8	18.8-19.9	18.8-19.8	18.8-19.9	18.6-19.8
Conductivity (mmho)												
X	128.25	-	140.50	-	135.50	-	136.50	-	137.75	-	136.5	-
S.D.	2.36	-	13.77	-	15.20	-	13.38	-	15.09	-	19.47	-
Range	125-130	-	128-149	-	128-150	-	121-150	-	121-151	-	121-160	-
Alkalinity (ppm)												
X	39.00	-	32.50	-	28.00	-	24.50	-	24.00	-	22.00	-
S.D.	6.22	-	4.34	-	5.09	-	3.42	-	3.65	-	7.12	-
Range	30-44	-	28-34	-	22-36	-	20-28	-	20-28	-	12-28	-
Hardness (ppm)												
X	66.00	-	65.00	-	70.50	-	71.25	-	75.50	-	75.75	-
S.D.	5.89	-	4.16	-	9.43	-	8.62	-	5.51	-	4.65	-
Range	60-72	-	60-70	-	62-84	-	66-84	-	70-82	-	71-82	-

Table I.C. Western Swamp: Water chemistry data for 21-day *Daphnia* bioassay.

	Control		68%		76%		88%		96%		100%	
	A	B	A	B	A	B	A	B	A	B	A	B
Dissolved Oxygen (ppm)												
x	8.62	-	8.07	-	7.99	-	7.87	-	7.55	-	7.47	-
S.D.	0.39	-	0.52	-	0.41	-	0.52	-	0.55	-	0.56	-
Range	8.2-9.0	-	7.6-8.8	-	7.5-8.5	-	7.4-8.1	-	7.0-8.2	-	6.9-8.0	-
pH												
x	5.45	-	5.40	-	5.42	-	5.45	-	5.45	-	5.47	-
S.D.	0.34	-	0.41	-	0.38	-	0.41	-	0.41	-	0.43	-
Range	5.0-5.8	-	5.0-5.8	-	5.1-5.8	-	5.1-5.9	-	5.1-5.9	-	5.1-5.9	-
Temperature (°C)												
x	19.01	-	18.98	-	18.99	-	19.00	-	18.99	-	18.97	-
S.D.	0.30	-	0.32	-	0.30	-	0.30	-	0.31	-	0.30	-
Range	18.7-19.8	-	18.6-19.8	-	18.6-19.7	-	18.6-19.8	-	18.6-19.7	-	18.6-19.6	-
Conductivity (umho)												
x	128.50	-	125.25	-	124.50	-	123.25	-	123.50	-	123.5	-
S.D.	4.43	-	0.50	-	3.42	-	3.20	-	2.38	-	4.51	-
Range	122-132	-	125-126	-	121-129	-	121-128	-	121-126	-	120-130	-
Alkalinity (ppm)												
x	41.50	-	35.50	-	23.50	-	25.00	-	21.00	-	19.00	-
S.D.	3.00	-	5.51	-	5.74	-	1.15	-	2.50	-	2.50	-
Range	38-44	-	30-42	-	16-30	-	24-26	-	18-24	-	16-22	-
Hardness (ppm)												
x	64.00	-	62.00	-	57.00	-	56.00	-	48.50	-	51.00	-
S.D.	17.44	-	26.68	-	15.36	-	13.86	-	8.39	-	7.57	-
Range	54-90	-	48-102	-	48-80	-	44-76	-	40-60	-	46-62	-

Table II.A. Background Sample: Water chemistry data for 7-day fish larvae bioassay.

	Control		60%		70%		80%		90%		100%	
	A	B	A	B	A	B	A	B	A	B	A	B
Dissolved Oxygen (ppm)												
$\bar{x}$	7.37	6.97	7.03	6.97	6.75	6.44	7.20	6.25	6.87	6.32	7.18	6.64
S.D.	0.55	0.87	0.67	0.79	0.84	1.07	0.58	1.38	0.82	1.23	0.71	1.28
Range	6.9-8.6	5.6-8.6	5.6-8.4	6.8-8.4	5.5-8.4	5.2-8.4	6.5-8.4	4.5-8.4	5.3-8.3	4.3-8.4	5.9-8.4	4.9-8.5
pH												
$\bar{x}$	6.58	6.58	6.59	6.59	6.59	6.59	6.56	6.55	6.57	6.57	6.68	6.68
S.D.	0.11	0.11	0.08	0.08	0.11	0.11	0.13	0.14	0.15	0.15	0.13	0.13
Range	6.4-6.7	6.4-6.7	6.5-6.7	6.5-6.7	6.4-6.7	6.4-6.7	6.3-6.7	6.3-6.7	6.3-6.7	6.3-6.7	6.4-6.7	6.4-6.7
Temperature (°C)												
$\bar{x}$	22.89	22.89	22.89	22.87	22.91	22.90	22.91	22.92	22.90	22.90	22.91	22.91
S.D.	0.42	0.42	0.42	0.45	0.44	0.44	0.43	0.45	0.44	0.44	0.43	0.43
Range	22.6-23.7	22.6-23.7	22.6-23.7	23.6-23.7	22.5-23.6	22.5-23.7	22.6-23.7	22.6-23.7	22.6-23.7	22.5-23.7	22.6-23.7	22.6-23.7
Conductivity (umho)												
$\bar{x}$	139.50	139.37	140.50	141.50	140.25	143.00	142.50	140.00	144.50	145.62	145.75	149.50
S.D.	4.60	8.57	5.21	6.02	6.58	6.02	3.70	9.89	4.93	7.17	5.37	8.16
Range	136-146	121-158	136-148	136-148	131-151	134-153	140-150	136-158	139-153	131-153	140-152	133-160
Alkalinity (ppm)												
$\bar{x}$	41.75	-	-	-	-	-	-	-	-	-	41.00	-
S.D.	1.28	-	-	-	-	-	-	-	-	-	2.83	-
Range	40-44	-	-	-	-	-	-	-	-	-	38-46	-
Hardness (ppm)												
$\bar{x}$	60.00	-	-	-	-	-	-	-	-	-	63.00	-
S.D.	2.39	-	-	-	-	-	-	-	-	-	6.85	-
Range	58-64	-	-	-	-	-	-	-	-	-	58-72	-

Table II.B. Airstripper: Water chemistry data for 7-day fish larvae bioassay

	Control		60%		70%		80%		90%		100%	
	A	B	A	B	A	B	A	B	A	B	A	B
Dissolved Oxygen (ppm)												
x̄	8.13	8.14	7.51	7.49	7.44	7.47	7.26	7.33	7.16	7.2	7.28	7.21
S.D.	0.29	0.25	0.23	0.28	0.36	0.34	0.32	0.27	0.38	0.25	0.19	0.16
Range	7.7-8.5	7.8-8.5	7.2-7.8	7.1-7.8	6.9-7.8	6.9-7.7	6.8-7.6	6.9-7.6	6.7-7.4	6.8-7.4	6.8-7.4	6.9-7.4
pH												
x̄	6.44	6.44	6.31	6.31	6.29	6.29	6.27	6.26	6.26	6.26	6.21	6.22
S.D.	0.09	0.09	0.11	0.11	0.08	0.08	0.10	0.09	0.09	0.09	0.10	0.12
Range	6.3-6.6	6.3-6.6	6.2-6.5	6.2-6.5	6.2-6.4	6.2-6.4	6.1-6.4	6.1-6.4	6.1-6.4	6.1-6.4	6.1-6.4	6.1-6.4
Temperature (°C)												
x̄	23.17	23.17	23.82	23.84	23.89	23.91	23.97	24.01	24.09	24.09	24.26	24.27
S.D.	0.16	0.16	0.39	0.41	0.41	0.42	0.51	0.49	0.54	0.54	0.68	0.57
Range	23.0-23.5	23.0-23.5	23.2-24.3	23.1-24.2	23.1-24.4	23.1-24.5	23.0-24.6	23.1-24.6	23.0-24.7	23.0-24.7	23.0-24.7	23.1-24.7
Conductivity (mmho)												
x̄	133.12	134.75	145.62	146.25	147.12	147.75	150.37	150.75	153.12	153.75	153.12	156.12
S.D.	2.23	2.38	5.50	5.31	4.52	4.53	6.00	6.04	8.46	8.48	7.78	8.72
Range	130-137	132-139	139-155	139-155	140-155	140-155	140-160	140-160	140-168	140-168	140-168	142-168
Alkalinity (ppm)												
x̄	41.50	-	-	-	-	-	-	-	-	-	26.00	-
S.D.	2.07	-	-	-	-	-	-	-	-	-	2.62	-
Range	38-44	-	-	-	-	-	-	-	-	-	24-30	-
Hardness (ppm)												
x̄	56-75	-	-	-	-	-	-	-	-	-	58.25	-
S.D.	3.54	-	-	-	-	-	-	-	-	-	2.25	-
Range	54-62	-	-	-	-	-	-	-	-	-	56-62	-

Table II.C. West Swamp: Water chemistry data for 7-day fish larvae bioassay.

	Control		6%		7%		8%		9%		10%	
	A	B	A	B	A	B	A	B	A	B	A	B
Dissolved Oxygen (ppm)												
X	7.51	7.76	7.49	7.44	7.28	7.29	7.14	7.13	7.38	7.29	7.19	6.93
S.D.	0.48	0.21	0.23	0.31	0.33	0.31	0.32	0.34	0.26	0.19	0.23	0.31
Range	6.7-8.8	7.4-8.8	7.1-7.7	6.9-7.9	6.7-7.7	6.9-7.6	6.5-7.5	6.5-7.6	7.0-7.8	7.0-7.5	6.9-7.5	6.5-7.4
pH												
X	6.43	6.44	6.33	6.31	6.26	6.25	6.21	6.28	6.15	6.14	6.04	6.03
S.D.	0.13	0.11	0.10	0.12	0.12	0.14	0.12	0.15	0.13	0.13	0.14	0.16
Range	6.2-6.6	6.3-6.6	6.2-6.5	6.1-6.5	6.1-6.5	6.0-6.5	6.0-6.4	5.9-6.4	5.9-6.3	5.9-6.3	5.8-6.2	5.8-6.2
Temperature (^{0}C)												
X	21.99	22.08	22.48	22.43	22.49	22.51	22.57	22.63	22.51	22.58	22.79	22.88
S.D.	0.47	0.49	0.61	0.61	0.69	0.78	0.79	0.84	0.57	0.56	0.28	0.27
Range	21.4-22.8	21.4-22.9	21.4-23.6	21.4-23.6	22.1-23.6	22.1-23.6	22.1-23.6	21.2-23.8	21.3-23.3	21.3-23.3	22.5-23.3	22.5-23.
Conductivity (mho)												
X	131.58	133.08	129.08	129.25	128.87	129.08	128.08	128.37	127.08	127.08	126.25	125.75
S.D.	1.77	2.08	3.46	3.73	4.54	4.47	4.63	4.74	4.78	4.72	4.03	4.18
Range	130-135	130-136	122-133	122-134	122-135	122-135	121-133	121-133	119-132	119-132	119-131	119-131
Alkalinity (ppm)												
X	44.75	-	-	-	-	-	-	-	-	-	38.75	-
S.D.	3.37	-	-	-	-	-	-	-	-	-	1.49	-
Range	42-46	-	-	-	-	-	-	-	-	-	38-34	-
Hardness (ppm)												
X	57.08	-	-	-	-	-	-	-	-	-	47.75	-
S.D.	3.02	-	-	-	-	-	-	-	-	-	2.25	-
Range	54-62	-	-	-	-	-	-	-	-	-	44-50	-

Table II.D. Sodium Lauryl Sulfate: Water chemistry data for 7-day fish larvae bioassay.

	Control		0.01 ppm		0.05 ppm		0.10 ppm		0.5 ppm		1 ppm	
	A	B	A	B	A	B	A	B	A	B	A	B
Dissolved Oxygen (ppm)												
X	6.34	6.78	6.56	6.88	6.92	6.84	6.72	6.66	6.78	6.66	6.72	6.64
S.D.	1.08	0.83	0.85	0.67	0.74	0.80	0.88	0.82	0.86	0.82	0.89	0.89
Range	5.3-7.7	5.8-7.5	5.5-7.7	6.8-7.8	6.1-7.8	5.8-7.8	6.8-7.8	5.8-7.8	5.7-7.8	5.7-7.9	5.8-8.8	5.7-8.8
pH												
X	6.62	6.62	6.62	6.66	6.78	6.66	6.68	6.66	6.78	6.68	6.78	6.78
S.D.	0.26	0.26	0.31	0.33	0.39	0.33	0.33	0.33	0.28	0.29	0.28	0.28
Range	6.3-6.9	6.3-6.9	6.3-7.0	6.3-7.0	6.3-7.2	6.3-7.0	6.3-7.0	6.3-7.0	6.4-7.0	6.4-7.0	6.4-7.0	6.4-7.0
Temperature (°C)												
X	23.52	23.52	23.34	23.58	23.52	23.58	23.66	23.64	23.62	23.60	23.68	23.58
S.D.	0.88	0.78	0.90	0.71	0.73	0.71	0.82	0.88	0.79	0.77	0.81	0.85
Range	22.2-24.1	22.2-24.8	22.3-24.8	22.3-24.8	22.3-24.8	22.3-24.8	22.3-24.3	22.3-24.2	22.3-24.2	22.3-24.2	22.3-24.2	22.3-24.2
Conductivity (umho)												
X	140.40	141.20	142.00	142.00	141.40	141.60	140.20	141.00	139.60	140.40	138.60	139.00
S.D.	3.36	3.27	4.18	4.12	4.83	4.34	3.56	4.64	3.91	4.72	6.35	6.96
Range	137-146	140-147	138-149	139-149	136-149	138-149	135-145	137-149	134-145	135-148	131-148	130-149
Alkalinity (ppm)												
X	42.00	-	-	-	-	-	-	-	-	-	41.20	-
S.D.	1.16	-	-	-	-	-	-	-	-	-	1.79	-
Range	42-44	-	-	-	-	-	-	-	-	-	40-44	-
Hardness (ppm)												
X	54.00	-	-	-	-	-	-	-	-	-	57.60	-
S.D.	5.48	-	-	-	-	-	-	-	-	-	1.67	-
Range	48-62	-	-	-	-	-	-	-	-	-	56-60	-

Table III.A. Flow rates for 21-day *Daphnia* bioassay.

	Flow Rates (ml/min)					
	Control	60%	70%	80%	90%	100%
Background Sample						
x	3.91	3.80	3.90	3.86	3.90	3.90
S.D.	0.16	0.13	0.14	0.16	0.11	0.13
Range	3.70-4.10	3.50-4.10	3.70-4.20	3.60-4.30	3.70-4.10	3.70-4.10
Airstripper						
x	3.62	3.67	3.59	3.63	3.71	3.66
S.D.	0.29	0.30	0.28	0.37	0.51	0.37
Range	3.08-4.31	3.40-4.56	3.25-4.35	3.11-4.77	3.20-5.38	3.22-4.50
Western Swamp						
x	3.66	3.78	3.74	3.81	3.69	3.72
S.D.	0.41	0.83	0.60	0.66	0.64	0.53
Range	3.27-5.33	3.13-7.17	3.25-6.00	3.40-6.33	3.29-6.33	3.33-5.67

Table III.B. Flow rates for 7-day fish larvae bioassay.

	Flow Rates (ml/min)					
	Control	60%	70%	80%	90%	100%
Background						
$\bar{X}$	4.24	4.31	4.37	4.42	4.37	4.30
S.D.	0.16	0.11	0.17	0.13	0.21	0.20
Range	4.0-4.5	4.2-4.5	4.2-4.6	4.2-4.7	4.2-4.7	4.0-4.6
Airstripper						
$\bar{X}$	4.29	4.37	4.14	4.40	4.44	4.43
S.D.	0.13	0.08	0.07	0.10	0.10	0.08
Range	4.1-4.5	4.3-4.5	4.3-4.5	4.3-4.6	4.3-4.6	4.3-4.5
West Swamp						
$\bar{X}$	4.53	4.33	4.46	4.47	4.49	4.44
S.D.	0.11	0.08	0.15	0.18	0.15	0.10
Range	4.4-4.7	4.2-4.4	4.3-4.6	4.2-4.7	4.3-4.7	4.3-4.6

Table IV.A. Sediment weights for 21-day *Daphnia* bioassay.

	Sediment Weights (g)					
	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5
Background						
x	175.00	175.00	175.00	175.00	175.00	175.00
Range	175.00-175.20	175.00-175.10	175.00-175.10	174.97-175.03	174.99-175.04	174.99-175-03
Airstripper						
x	175.30	175.10	174.70	175.00	175.10	174.90
Range	175.20-175.50	174.70-175.40	174.50-175.10	174.50-175.50	174.60-175.40	174.50-175.3
Western Swamp						
x	174.90	174.95	175.07	175.31	174.79	175.07
Range	174.54-175.36	174.52-175.42	174.68-175.35	175.00-175.49	174.59-175.26	174.56-175.23

Table IV.A. (continued). Sediment weights of 21-day *Daphnia* bioassay.

	Sediment Weights (g)					
	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11
Background						
x	175.00	175.00	175.00	175.00	175.0	175.00
Range	174.99-175.02	175.00-175.02	174.99-175.02	174.99-175.01	175.00-175.01	175.00-175.01
Airstripper						
x	175.00	175.00	175.00	175.20	175.20	175.00
Range	174.50-175.50	174.50-175.40	174.50-175.40	174.70-175.40	174.80-175.50	174.55-175.10
Western Swamp						
x	175.11	174.81	174.90	174.90	175.13	175.07
Range	174.54-175.48	174.52-175.20	174.50-175.41	174.53-175.31	174.60-175.47	174.73-175.50

Table IV.A. (continued). Sediment weights for 21-day *Daphnia* bioassay.

	Sediment Weights (g)					
	Day 12	Day 13	Day 14	Day 15	Day 16	Day 17
Background x Range	175.00 174.99–175.01	175.00 174.99–175.00	175.06 174.97–175.13	175.20 175.07–175.44	174.98 174.81–175.50	175.05 174.48–175.36
Airstripper x Range	174.90 174.50–175.20	175.10 174.80–175.50	175.10 174.70–175.50	175.20 174.90–175.50	174.80 174.50–175.00	175.10 174.80–175.50
Western Swamp x Range	175.18 174.76–175.45	174.92 174.58–175.33	175.09 174.60–175.46	174.96 174.35–175.45	174.84 174.40–175.60	174.88 174.52–175.29

Table IV.A. (continued). Sediment weights for 21-day *Daphnia* bioassay.

	Sediment Weights (g)					
	Day 18	Day 19	Day 20	Day 21		
Background						
x	175.19	174.74	174.84	175.10	175.01	x of x's
Range	174.96-175.42	174.64-175.02	174.22-175.00	174.79-175.42	174.74-175.20	Range of x's
					0.09	S.D. of x
Airstripper						
x	175.00	175.20	175.20	174.90	175.00	x of x's
Range	174.50-175.40	174.80-175.50	174.60-175.50	174.50-175.20	174.70-175.30	Range of x's
					0.15	S.D. of x
Western Swamp						
x	174.87	175.16	175.07	175.20	175.01	x of x's
Range	174.53-175.40	174.61-175.41	174.52-175.45	174.79-175.46	174.79-175.31	Range of x's
					0.14	S.D. of x

Table IV.B. Sediment weights for 7-day fish larvae bioassay.

	Sediment Weights (g)								
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7		
Background									
$\bar{x}$	175.0	175.3	175.1	174.9	175.1	175.1	175.5	175.1	$\bar{x}$ of $\bar{x}$'s
Range	174.9–175.2	175.1–175.6	174.2–175.8	174.7–175.0	174.5–175.8	174.5–175.5	174.6–175.8	174.9–175.5	Range of $\bar{x}$'s
								0.20	S.D. of $\bar{x}$'s
Airstripper									
$\bar{x}$	175.0	175.2	175.1	175.1	175.1	175.1	175.3	175.1	$\bar{x}$ of $\bar{x}$'s
Range	174.7–175.4	174.8–175.5	175.0–175.3	174.7–175.5	174.6–175.2	174.6–175.4	175–175.5	175–175.3	Range of $\bar{x}$'s
								0.09	S.D. of $\bar{x}$'s
West Swamp									
$\bar{x}$	175.1	175.0	175.0	175.2	175.1	175.2	175.2	175.11	$\bar{x}$ of $\bar{x}$'s
Range	174.8–175.3	174.7–175.3	174.9–175.4	174.8–174.4	174.7–175.4	174.7–175.5	174.7–175.5	175.0–175.1	Range of $\bar{x}$'s
								0.09	S.D. of $\bar{x}$'s

Table V.A. Background: Survival and reproduction data for 21-day *Daphnia* bioassay.

Concentration %		Survivorship Day 0	Day 6	Day 14	Day 21	Mean Accumulated Neonates/Adult
Control	A	10	10	9	9	68.1
	B	10	10	10	10	48.8
60%	A	10	10	6	1	6.0
	B	10	9	9	4	1.9
70%	A	10	9	7	4	16.8
	B	10	10	7	4	4.2
80%	A	10	8	6	1	2.7
	B	10	9	7	5	3.3
90%	A	10	8	6	3	5.8
	B	10	10	8	3	7.4
100%	A	10	7	6	2	0.6
	B	10	9	4	2	2.0

Table V.B. Airstripper: survival and reproduction data for 21-day *Daphnia* bioassay.

Concentration %		Survivorship Day 0	Day 6	Day 14	Day 21	Mean Accumulated Neonates/Adult
Control	A	10	9	9	9	65.76
	B	10	10	10	10	60.20
60	A	10	10	10	10	36.80
	B	10	10	9	7	29.71
70	A	10	10	9	2	12.25
	B	10	10	9	5	19.27
80	A	10	9	10	7	0.93
	B	10	9	9	5	0.22
90	A	10	10	9	2	9.00
	B	10	10	10	2	1.81
100	A	10	10	8	0	0.00
	B	10	10	9	3	0.22

Table V.C. Western Swamp: Survival and reproduction data for 21-day *Daphnia* bioassay.

Concentration %		Survivorship Day 0	Day 6	Day 14	Day 21	Mean Accumulated Neonates/Adult
Control	A	10	10	10	10	55.5
	B	10	10	10	10	60.4
60%	A	10	10	7	5	30.4
	B	10	10	9	7	36.8
70%	A	10	10	7	5	20.9
	B	10	9	8	5	23.6
80%	A	10	9	8	3	23.6
	B	10	8	8	5	19.7
90%	A	10	9	8	1	21.0
	B	10	9	8	4	15.4
100%	A	10	9	6	1	13.1
	B	10	9	8	1	15.7

Table V.D. Sodium Lauryl Sulfate: Survival data for 48-h *Daphnia* bioassay.

Concentration (mg/l)		Survivorship Day 0	Day 2
0.00	A	10	10
	B	10	10
3.625	A	10	8
	B	10	10
7.25	A	10	4
	B	10	9
14.5	A	10	0
	B	10	0
29.0	A	10	0
	B	10	0
57.81	A	10	0
	B	10	0

Table VI. Acute and chronic toxicity results for 21-day *Daphnia* bioassay.

Toxicant	Acute Toxicity			Chronic Toxicity				
	No. Days	LC_{50} (ppm)	95% Conf. Limits	Mean Sq. Among	Mean Sq. Within	F_s	P	T-method Results
Sodium Lauryl Sulfate	1	14.96	lower = 12.82 upper = 17.46					
	2	7.93	lower = 6.55 upper = 9.61			Not Applicable		
Background Sample	6 14 21	not calc. not calc. not calc.	– – –	978.44	46.88	21.86	p<.001	0 60 70 80 90 100
Airstripper Sample	6 13 21	not calc. not calc. 74.03	– – lower = 68.99 upper = 79.45	1281.86	15.32	78.98	p<.001	0 60 70 80 90 100
Western Swamp	6 14 21	not calc. not calc. 69.64	– – lower = 57.26 upper = 84.78	513.10	10.47	49.02	p<.001	0 60 70 80 90 100

Table VII.A. Background: 7-day fish larvae bioassay survival and growth data.

Concentration (%)	Rep	Survivorship Day 0	Survivorship Day 7	Ave. Body Wt. (mg)	Ave. Body Length (mm)
Control	A	10	5	0.2025	7.43
	B	10	8	0.2888	6.44
60	A	10	2	0.1000	6.84
	B	10	3	0.3167	7.49
70	A	10	3	0.3367	7.38
	B	10	4	0.2950	7.26
80	A	10	4	0.2350	6.92
	B	10	7	0.2071	6.64
90	A	10	3	0.3100	7.04
	B	10	5	0.2980	7.26
100	A	10	6	0.1650	7.52
	B	10	5	0.4260	6.69

Table VII.B. Airstripper: 7-day fish larvae bioassay survival and growth data.

Concentration (%)	Rep	Survivorship Day 0	Survivorship Day 7	Ave. Body Wt. (mg)	Ave. Body Length (mm)
Control	A	10	8	0.2425	7.43
	B	10	9	0.2411	7.15
60	A	10	10	0.2440	7.23
	B	10	9	0.2511	7.11
70	A	10	6	0.2700	7.12
	B	10	8	0.2462	7.33
80	A	10	7	0.2257	7.02
	B	10	6	0.2650	7.04
90	A	10	7	0.3228	7.48
	B	10	8	0.2888	7.26
100	A	10	8	0.2975	7.33
	B	10	7	0.2757	7.19

Table VII.C. West Swamp: 7-day fish larvae bioassay survival and growth data.

Concentration (%)	Rep	Survivorship Day 0	Survivorship Day 7	Ave. Body Wt. (mg)	Ave. Body Length (mm)
Control	A	10	8	0.5143	8.59
	B	10	10	0.4100	8.01
60	A	10	7	0.3971	7.94
	B	10	7	0.3871	7.79
70	A	10	9	0.4644	7.92
	B	10	9	0.4211	7.83
80	A	10	9	0.4500	7.79
	B	10	9	0.4478	8.18
90	A	10	8	0.4538	7.90
	B	10	9	0.4633	7.86
100	A	10	8	0.4338	7.98
	B	10	9	0.4144	7.81

Table VII.D. Sodium Lauryl Sulfate: 7-day fish larvae bioassay survival and growth data.

Concentration (mg/l)	Rep	Survivorship Day 0	Survivorship Day 7	Ave. Body Wt. (mg)	Ave. Body Length (mm)
Control	A	10	9	0.1091	6.16
	B	10	8	0.1025	6.10
0.01	A	11	9	0.1433	6.57
	B	13	10	0.1250	6.44
0.05	A	15	12	0.1458	6.53
	B	12	8	0.1175	6.27
0.10	A	12	9	0.1522	6.83
	B	10	6	0.1540	6.55
0.5	A	11	11	0.1582	6.77
	B	12	5	0.1280	6.32
1.0	A	11	8	0.1612	6.78
	B	11	9	0.1767	6.83

APPENDIX S

SEDIMENT TOXICITY BIOASSAY REPORT

19th & the Parkway Philadelphia, PA 19103

9 July 1987

EXECUTIVE SUMMARY

Two laboratory bioassays were performed on six potentially toxic soil samples, one control soil sample and on dilution water to determine leachate effects on survival and reproduction of *Daphnia magna*. A liquid-phase elutriate test determined acute toxicity to new born daphniids during a 48-h exposure. No toxicity was observed. A solid-phase sediment test measured survival and reproduction during an initial 48-h period, followed by an additional exposure for eight days. Again, no acute toxicity was observed. Significant statistical effects on reproduction were observed during the full exposure period. When compared with the control soil sample (site 6), daphniids exposed to soils from site 1 (ditch in vicinity of railroad compressed gas tanks), site 3 (west swamp/pond), and site 7 (area of elevated DDT levels) had lower reproduction. When compared with the dilution water control, sites 1 and 3 had an impact on daphniid reproduction.

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INTRODUCTION

The second series of soil-leachate bioassays on the Tyson Site soil samples consisted of exposing *Daphnia magna* to soil leachate or to direct contact with soils immersed in dilution water. These tests followed protocols described in Nebeker et al. (1984).

The protocols were modified with the approval of Dr. Allen Nebeker, of the EPA Corvallis Environmental Research Laboratory (telephone conversation on 5 May 1987). These modifications are described below.

METHODS

The bioassays consisted of three separate tests with *Daphnia magna* following protocols from Nebeker et al. (1984):

1) Liquid phase elutriate (p. 620);
2) Solid phase sediment and water beaker test (p. 621);
3) *Daphnia magna* life cycle test (p. 622).

The two tests described in protocols 2 and 3 were combined. The results on survival of 5-day old daphniids were obtained at the end of the first 48 h (protocol 2). These animals were then returned to the culture vessels with soils and the test run for an additional 8 days, thus equaling the 10-day period required in protocol 3. This modification was approved by A. Nebeker.

Bioassays were performed on seven soil samples and a river water control:

Sample No.	Description
1	Ditch in vicinity of railroad compressed gas tanks
2	Air stripper discharge ditch
3	West swamp/Pond
4	Ditch near signal tower
5	Ditch draining western end of site
6	Ditch approximately one-half mile west of western site boundary (Control)
7	Area of elevated DDT levels found during previous investigations
8	Schuylkill River water

All test soil samples and the river water control were run in triplicate jars for replication. The dilution water was collected from the Schuylkill River near Valley Forge (Betzwood Bridge boat launch) on two separate dates, 6 and 8 May. This water was filtered through a Whatman No. 4 filter prior to use to eliminate animals that might affect the daphniids, such as predatory copepods.

The *Daphnia magna* used in the tests were obtained from a culture maintained for several years in our laboratory, and originally obtained from EPA's Duluth, Minnesota Environmental Research Laboratory. The animals were acclimated for five days in Schuylkill River water prior to obtaining test animals. They were fed *Ankistrodesmus falcatus* that was cultured on ASM medium, with vitamin additions, following Goulden et al. (1982).

All glassware was acid washed (30% HCl) for 30 min, acetone rinsed, and then rinsed several times in distilled water, followed by several Milli-Q water rinses, prior to use.

A. Liquid phase elutriate test.

For this test, the leachate was prepared from 350-ml soil samples in 1400 ml of dilution water in one-gallon jars. The samples were then vigorously shaken on an extractor similar to the design published in ASTM Designation: D 3987--85. Samples were allowed to stand overnight and were then centrifuged in Nalgene bottles at 15,000 rpm for 30 min (as recommended by A. Nebeker). The centrifuged sample leachate was then added to each of three 250-ml beakers (200 ml each) for each soil and river water sample. Acclimated adult animals were isolated in beakers with clean water and food the evening prior to beginning the test. The next morning, neonates were separated from these beakers for the test. Ten *Daphnia* neonates were placed in each beaker. After 48 h, all survivors were counted. Chemical tests (oxygen, pH, alkalinity, conductivity) and temperature were recorded in one beaker per substance. There was no diminution in oxygen during the first 24 h, so no aeration was necessary.

B. Solid phase sediment and water beaker test/*Daphnia magna* life-cycle test.

Three replicate vessels were maintained for each soil sample. The vessels consisted of 4-L wide-mouth jars (soda ash wide mouth jars, as per suggestion of A. Nebeker). Five hundred milliliters of sample soil was first placed in each vessel, and then 2500 ml of Schuylkill water was gently poured into each

vessel. The sediment in these jars was allowed to settle for three days prior to beginning the test. We had found in a preliminary test that these vessels would remain very turbid for two to three days after the soil was added. A. Nebeker proposed the procedure followed here.

Prior to starting the test, each vessel was aerated for 30 min with glass tipped airlines and aeration continued throughout the test. Algae was added to each vessel every other day, at a concentration of 40,000 cells/ml of *Ankistrodesmus*. This food and concentration was approved in conversation with A. Nebeker. The cultures were maintained in a 20°C room with low-light levels and a photoperiod of 16 h light, 8 h dark.

After 48 h, all surviving adults were counted in each vessel. The animals were thereafter left undisturbed, except for feeding, and water chemistry and temperature analysis, for eight days. At the end of the full 10 days, the water in each bottle was poured through a 120-um mesh screen to retain the animals, and these were then transferred to a jar with formalin preservative and stored until counts could be made. The animals in each bottle were counted under a microscope.

The resulting data for population size was analyzed by a one-way Analysis of Variance (ANOVA) with linear contrasts using the LMGLH program of SYSTAT, Version 3 developed for personal computers. Homogeneity of group variances was determined by Bartlett's test (Wilkinson, 1986), and by the F(max) test described in Sokal and Rohlf (1981). All results for survival and total number of animals after 10 days for each soil sample was contrasted against the control soil sample and against river water. To establish the level of alpha in this linear contrast, we used Bonferonni's procedure (Wilkinson, 1986), the original alpha of 0.05, was divided by the number of planned comparisons (k) to give a new alpha value for distinguishing significant effects.

RESULTS

Physical and chemical data on all cultures are listed in Tables 1 and 2. No serious deviations occurred except for low dissolved oxygen values in soil sample # 2. The low values do not appear to have affected the test animals.

The results for neonate survival during 48 h, Test 1, are given in Table 3. No deaths were observed in the soil leachate samples.

The results for 48-h survivorship of the five-day-old daphniids are given in Table 4. Only one death occurred, in one of the control replicates (sample 6).

The data for adult survivorship after 10 days, and reproduction, as indicated by the total number of animals present in each bottle after 10 days, are given in Table 4. Significant differences in adult survival ($P > 0.918$) after 10 days were not observed among the vessels containing the array of sediment samples.

Significant differences were observed ($P = 0.000$) among total animals in sample vessels at the end of 10 days as compared with the control soil sample vessels (Table 4). Soil samples 1, 3 and 7 had significantly fewer animals than did the control (# 6) vessels. Soil sample #4 shows a difference (i.e., $P = 0.012$), but if we are to be conservative about the number of contrasts to be made in this ANOVA, as recommended in all multiple comparisons, and use Bonferroni's method and divide $\alpha = 0.05$ (our normal level of significance) by the number of planned comparisons ($k = 7$), then we should accept no P value greater than 0.007. Thus, sample # 4 total number of animals would not be accepted as different from the control populations.

Significant differences in total number of animals in vessels were also found when the linear contrast was with the results for the river water vessels. These results were planned only for the samples that were significant in the soil comparisons, i.e., only comparisons among samples 1, 3 and 7 were made.

Table 1. Chemical and physical data for the liquid phase elutriate test.

Site #	D.O. (mg/L)	pH	Hardness (mg/L)	Alkalinity (mg/L)	Conductivity (umhos/cm)	Temperature (°C)
1	8.0	6.9	66	40	251	19.9
2	7.3	6.9	76	40	247	19.9
3	7.8	7.0	92	44	245	19.9
4	7.6	7.0	104	48	260	19.9
5	7.0	7.0	126	46	340	19.9
6	6.8	7.1	112	48	262	19.9
7	6.9	7.0	108	40	235	19.9
8	8.0	6.9	112	56	280	19.9

Table 2. Average physical and chemical data for the *Daphnia magna* life cycle test. The data are averages, standard deviation (S.D.) and ranges for measurements made on days 1, 2, 7 and 9.

Sites:	1	2	3	4	5	6	7	8
D.O. (ppm)								
$\bar{x}$	7.8	6.7	7.8	7.8	7.7	7.8	7.5	8.4
S.D.	0.06	0.12	0.15	0.0	0.17	0.0	2.3	0.06
Range	7.4-8.4	4.4-8.0	7.2-8.2	7.2-8.4	7.0-8.4	7.0-8.4	5.3-8.4	7.8-8.6
pH								
$\bar{x}$	7.4	7.6	7.5	7.5	7.6	7.8	7.2	7.5
S.D.	0.15	0.10	0.06	0.06	0.0	0.06	0.06	0.06
Range	7.2-7.5	7.3-7.9	7.2-7.8	7.3-7.7	7.3-7.9	7.6-8.0	7.0-7.4	7.2-7.6
Temperature (°C)								
$\bar{x}$	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
S.D.	-*	-	-	-	-	-	-	-
Range								
Conductivity (umhos/cm)								
$\bar{x}$	305	351	319	313	326	315	272	323
S.D.	2.0	10.97	20.21	5.69	6.03	4.04	0.57	0.0
Range	290-320	280-400	280-325	300-330	290-355	265-355	265-280	280-355

* Temperatures did not vary during testing period.

Table 3. Survivorship data for 48 hours liquid phase elutriate test of seven sediment samples and dilution water.

Site #	Number alive		
	0 hours	24 hours	48 hours
1a	10	10	10
b	10	10	10
c	10	10	10
2a	10	10	10
b	10	10	10
c	10	10	10
3a	10	10	10
b	10	10	10
c	10	10	10
4a	10	10	10
b	10	10	10
c	10	10	10
5a	10	10	10
b	10	10	10
c	10	10	10
6a	10	10	10
b	10	10	10
c	10	10	10
7a	10	10	10
b	10	10	10
c	10	10	10
8a	10	10	10
b	10	10	10
c	10	10	10

Table 4. Survivorship and total *Daphnia* in replicate vessels and p for linear contrasts ANOVA for 7 sediment samples and dilution water.

Soil Sample #	Day 0 # of 5-day Old *Daphnia*	Day 2 # of Adult *Daphnia*	Day 10 # of Surviving Adult *Daphnia*	Total *Daphnia*	P Linear Contrast with Sediment Control (α=0.007)	P Linear Contrast with Dilution Water Control (α=0.016)
1a	15	15	15	303		
b	15	15	15	419	0.000	0.01
c	15	15	11	385		
2a	15	15	15	615		
b	15	15	14	718	0.991	
c	15	15	15	583		
3a	15	15	15	347		
b	15	15	13	221	0.000	0.001
c	15	15	14	382		
4a	15	15	14	490		
b	15	15	14	442	0.012	
c	15	15	14	490		
5a	15	15	13	597		
b	15	15	14	626	0.861	
c	15	15	14	722		
6a	15	15	14	714		
b	15	14	14	634	Control	
c	15	15	14	566		
7a	15	15	15	307		
b	15	15	15	447	0.001	0.039
c	15	15	14	474		
Schuylkill River Sample						
8a	15	15	15	601		
b	15	15	12	452	0.108	Control
c	15	15	15	565		

Thus, to obtain the level of signifcance we divide 0.05 by k = 3. Any P < 0.016 would be considered as signifying an impact. These P values are given in Table 5. Only soil samples 1 and 3 are different from the river water control; sample 7 is not.

It should be apparent that this difference in contrasts between the sediment control and the river water control result because the sediment control vessels had more animals at the end of the 10-day period. This may result from nutrients (nitrogen and phosphorus) present in the soil control, stimulating the growth of algae during the test.

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T

APPENDIX T

ANALYTICAL VALIDATION REVIEWS

TYSONS SITE
QUALITY ASSURANCE REVIEW

28 July 1987

Environmental Resources Management, Inc.
999 West Chester Pike
West Chester, Pennsylvania 19382

File 272-11

Tysons Site

Quality Assurance Review

The following quality assurance report is based upon a review of the data generated for the following samples which are selected solid samples from the seep area, hillside area, railroad area, and the wetlands/floodplain area. Only the following samples are included in this review.

ERM Sample #	Lancaster Sample #1
SS011	1081255
SS013	1081257
SS017	1082289
SS020	1082295
SS022	1082297
SS038	1084412
SS041	1084414
SS043	1084417
SS058	1085741
SS059	1085742
SS060	1085743
SS066	1087880
SS067	1087878

This review was performed in accordance with the National Functional Guidelines for Evaluating organic and inorganic Analyses (USEPA).

1.0 Organic Data

1.1 Introduction

The organic analyses of 13 soil samples were performed by Lancaster Laboratories of Lancaster, Pennsylvania. These samples were analyzed using EPA methodologies for the volatile target compound list (TCL) and 1 additional volatile compound plus up to 15 library searches for extraneous chromatographic peaks, acid/base/neutral TCL plus up to 25 library searches for extraneous chromatographic peaks and priority pollutant pesticides/ PCBs. The findings offered in this report are based upon a detailed review of all available documentation of sample data, holding times, blank results, surrogate and matrix spike recoveries, evaluation of GC results, target compound matching quality, instrument tuning, calibrations, quantitation of positive results, and tentatively identified compounds.

In general, the organic analyses of the aforementioned soil samples were performed acceptably with the exception of a few minor problems requiring several qualifying statements.

1.2 Qualifiers

- Due to the low level presence of acetone, 2-butanone, carbon disulfide, methylene chloride, chloroform, toluene, di-n-butyl phthalate, and bis (2-ethylhexyl) phthalate in field and/or laboratory blanks, the presence of these compounds in the following samples is qualitatively questionable. This has been indicated with a "B" next to these reported results on the attached sample data summary.

Compound	Samples with Questionable Results
acetone	All positive sample results
2-butanone	SS038,SS041, SS060, and SS067
carbon disulfide	SS038
methylene chloride	All positive sample results
chloroform	SS066
toluene	SS017, SS038, SS058, and SS059
di-n-butyl phthalate	SS011, SS038, SS058 and SS059
bis(2-ethylhexyl) phthalate	SS038

- The reported presence of 3-nitroaniline and 4-chloroaniline in sample SS017 and N-nitrosodiphenylamine in sample SS058 was incorrectly identified by the laboratory. The mass spectra submitted for these identification revealed poor matches to the above mentioned target compounds. The laboratory manager was contacted and agrees with the reviewer's assessment. Accordingly, these results have been deleted from the sample data summary.

- Due to a laboratory transcription error aldrin was reported in samples SS038 and SS041, the laboratory apparently meant to report gamma-BHC (lindane) in both of these samples. However, these corrected results for gamma-BHC are still questionable since the method of analysis is based upon a single peak response of dual GC columns. This method can easily generate artifactual results due to random chromatographic interferences particularly for early eluting compounds like gamma-GHC. In addition, for both of these results the signal peak response on the confirmation column fell outside a 3-sigma retention time window.

Furthermore, the peak that both of the identifications were based upon (on the primary column) was also present on a field blank chromatogram. These results for lindane have been designated suspected unreliable "S" on the sample data summary.

- The presence of 4,4'-DDT in sample SS011, 4,4'-DDD and 4,4'-DDE in sample SS067 have been confirmed by GC/MS. In addition, several other low level results for 4,4'-DDT and 4,4'-DDD were identified by a single peak response on dual GC columns. These low level pesticide results would ordinarily be considered suspect; however, in this case they are strongly supported by the high level results confirmed by GC/MS in other samples obtained from the floodplain:

- Due to an obvious laboratory quantitation error, the reported concentration of 20 ug/l for tetrachloroethene in sample SS038 is incorrect. The laboratory did not take into account a dilution factor of 10 in the final quantitation which brings the corrected concentration to 200 ug/L for this result. The sample data summary has been modified to reflect this change.

- The positive results and/or detection limits for all BNA compounds in samples SS017 and SS043 may be higher than reported since the laboratory reported data based upon a reextraction which was performed 51 and 40 days (respectively) beyond the holding time prior to extraction of 10 days after sample receipt. Therefore the positive results for BNA compounds in sample SS017 have been flagged with "J" on the sample data summary. It should be noted that the effect of excessive holding time for extractable analyses is most pronounced for the acid and base compounds.

- Although the laboratory has reported the presence of benzo (b) fluoranthene in samples SS013, SS020, SS022 SS038 and SS058 the reviewer has appropriately placed these identifications under benzo (b and/or k) fluoranthene on the sample data summary. This is because under some circumstances these spectrally identical isomers can be resolved chromatographically. In this case, for the analyses performed, identical retention times were obtained for both the laboratory standards and the samples that have positive results for these compounds.

- Due to a sample matrix problem for sample SS013, 4-methylphenol was not detected in the automated ion

search. However, examination of the tentatively identified compounds revealed a acceptable mass spectrum of 4-methylphenol at the appropriate retention time relative to the continuing calibration standard. The reviewer has quantitated this compound using the appropriate response factor and added this identification to the sample data summary.

- The reported detection limits for 3-nitroaniline and 4-nitroaniline in samples SS066 and SS067 are unreliable and may be substantially higher than reported. This is because examination of the associated 50 ppb continuing calibration standard revealed response factors for these compounds of less than 0.05. Response factors such as these indicate a lack of sensitivity for these compounds. Accordingly a valid detection limit cannot be estimated.

- Tentatively identified compounds of confident matching quality which are not suspected artifacts/lab contaminants are presented on the last few pages of the sample data summary. In particular, the presence of 4,4'-DDT, 4,4'-DDD, and 4,4'-DDE were confirmed by GC/MS as tentatively identified compounds.

2.0 Inorganic Data

2.1 Introduction

The inorganic analyses of 13 soil samples were performed by Lancaster Laboratories. These samples were analyzed using EPA approved methodologies for Task I and II metals. The findings offered in this report are based upon a detailed review of all available documentation of sample data, holding times, blank results matrix spike recoveries, quantitation of positive results, calibrations and detection limits.

In general, the inorganic analyses were performed acceptably with the exception of a few minor problems requiring several qualifying statements:

2.2 Qualifiers

- Due to the low level presence of arsenic, selenium, thallium, vanadium and tin in field and/or laboratory blanks, the presence of these constituents in the following samples is qualitatively questionable. This has been indicated with a "B" next to the reported results on the attached sample data summary.

Constituent	Samples with Questionable Results
arsenic	SS011
selenium	All positive sample results
thallium	All positive sample results
vanadium	SS067
tin	All positive sample results

- Several trace level results for aluminum, beryllium, cadmium, manganese and mercury, silver have been designated not valid "NV" on the sample data summary. Examination of the absorbance/concentration data for the standards provided for these metals/metaloids revealed the all valves which have been flagged with an "NV" are below reliable instrument detection capability. The following estimated detection limits for these constituents correspond to the lowest concentration detectable for a 0.003 absorbance. Below 0.003 absorbance an analyte signal is not discernable from instrument "nois

Constituent	Best Possible Detection Limit
beryllium	0.25 mg/kg
mercury	0.30 mg/kg
aluminum	10 mg/kg
cadmium	0.08 mg/kg
manganese	0.30 mg/kg
silver	0.18 mg/kg

It should be noted that these detection limits should be converted to dry weight on an individual sample basis. For example although the reported result for silver in sample SS067 (0.23 mg/kg) appears to be over the 0.18 mg/kg detection limit, it is actually 0.06 mg/kg before dry weight correction and has accordingly be flagged with an "NV".

- The reported results for copper in samples SS058, SS059, and SS060 cannot be quantitatively verified since a continuing calibration standard which measures instrument stability was not analyzed with these samples.

- Inorganic data could not be fully verified to the extent that is normally possible because "raw data" consisted of copies of analysts notebook pages and not instrument printouts.

3.0 Summary

The attached quality assurance has stated several qualifying statements. It is recommended that this data package be utilized only with these qualifiers. Please see the accompanying support documentation for specifies on the review.

Report prepared by Rock J. Vitale_____ Date_____
QA/QC Manager

File No. 272-11

TYSONS SITE

QUALITY ASSURANCE REVIEW

27 July 1987

Prepared by:

Environmental Resources Management, Inc.
999 West Chester Pike
West Chester, PA 19382

TYSON'S SITE
QUALITY ASSURANCE REVIEW

The following quality assurance report is based upon a review of the data generated for the samples presented on Table 1.

This review was performed in accordance with the Functional Guidelines for Evaluating Organic and Inorganic Analyses (USEPA).

1.0 Organic Data

1.1 Introduction

The organic analysis of 31 Aqueous samples and 16 solid samples were analyzed using EPA's Contract Laboratory Program (CLP) protocols. The majority were analyzed for volatile priority pollutant/hazardous substance list compounds and one additional volatile compound (1,2,3-trichloropropane), and acid/base/neutral extractable priority pollutant/hazardous substance list compounds. Library searches were conducted for extraneous chromatographic peaks. Several samples were also analyzed for pesticides/PCBs. The findings offered in this report are based upon a detailed review of all available documentation of sample data, holding times, blank results, surrogate and matrix spike recoveries, evaluation of GC results, target compound matching quality, instrument tuning, calibrations/quantitation, and tentatively identified compounds.

In general, the organic analysis of the aforementioned samples was performed acceptably with the exception of a few problems requiring several qualifying statements.

1.2 Qualifiers

- Due to the low level presence of methylene chloride, acetone, 2-butanone, toluene, chloroform, benzene, bis(2-ethylhexyl)phthalate, di-n-butyl phthalate and butylbenzyl phthalate. In trip and/or laboratory blanks, the presence in the following samples is qualitatively questionable. This has been indicated with a "B" on the sample data tables.

TABLE 1

SAMPLES AND PARAMETERS ANALYZED

ERM Sample	Parameters
BA-001C	VOAs, BNA, Pest/PCBs, Metals
BA-002C	VOAs, BNA, Pest/PCBs, Metals
BA-003C	VOAs, BNA, Pest/PCBs, Metals
BA-004C	VOAs, BNA, Pest/PCBs, Metals
BA-005C	VOAs, BNA, Pest/PCBs, Metals
BA-006C	VOAs, BNA, Pest/PCBs, Metals
BA-007C	VOAs, BNA, Pest/PCBs, Metals
BA-008C	VOAs, BNA, Pest/PCBs, Metals
BA-009	VOAs, BNA, Pest/PCBs, Metals
BA-0010	VOAs, BNA, Pest/PCBs, Metals
BA-0011	VOAs, BNA, Pest/PCBs, Metals
BA-0012	VOAs, BNA, Pest/PCBs, Metals
BA-0013	VOAs, BNA, Pest/PCBs, Metals
BA-0014	VOAs, BNA, Pest/PCBs, Metals
BA-0015	VOAs, BNA, Pest/PCBs, Metals
Station A (April 87)	VOAs Only
Station B (April 87)	VOAs Only
Station C (April 87)	VOAs Only
Station D (April 87)	VOAs Only
Station E (April 87)	VOAs Only
Station F (April 87)	VOAs Only
Station G (April 87)	VOAs, BNA, Pest/PCBs, Metals
Station H (April 87)	VOAs, BNA, Pest/PCBs, Metals
Station I (April 87)	VOAs Only
Station J (April 87)	VOAs Only
Station K (April 87)	VOAs, BNA, Pest/PCBs, Metals
BA-001S	VOAs, BNA, Pest/PCBs, Metals, TOC, and Grainsize
BA-002S	VOAs, BNA, Pest/PCBs, Metals, TOC, and Grainsize
BA-003S	VOAs, BNA, Pest/PCBs, Metals, TOC, and Grainsize
BA-004S	VOAs, BNA, Pest/PCBs, Metals, TOC, and Grainsize
BA-005S	VOAs, BNA, Pest/PCBs, Metals, TOC, and Grainsize
BA-006S	VOAs, BNA, Pest/PCBs, Metals, TOC, and Grainsize
BA-007S	VOAs, BNA, Pest/PCBs, Metals, TOC, and Grainsize

TABLE 1
(continued)

ERM Sample	Parameters
FP-001	VOAs, BNAs, and Pest/PCBs
FP-002	VOAs, BNAs, and Pest/PCBs
FP-003	VOAs, BNAs, and Pest/PCBs
FP-004	VOAs, BNAs, and Pest/PCBs
FP-005	TOC Only
FP-006	TOC Only
FP-007	TOC Only
FP-008	TOC Only
FP-009	TOC Only
Weir #4 (TR 1475)	VOAs, BNAs, Pest/PCBs and Metals
Stripper Effuent (TR 1479)	VOAs, BNA, and Pest/PCBs
Stripper Influent (TR 1478)	VOAs, BNA, and Pest/PCBs
Weir #4 (TR 1482)	VOAs, BNA, and Pest/PCBs

Compound	Samples with Questionable Results
methylene chloride	All positive sample results
acetone	All positive sample results
toluene	BA-005S
benzene	BA-002S
chloroform	BA-001C, BA-003C, BA-004C, and BA-007C
bis(2-ethylhexyl)phthalate	BA-010, BA-014, and Weir #4 (TR1475)
di-n-butyl phthalate	BA-007S
butylbenzyl phthalate	BA-003C

- Many results for acetone from samples obtained from the floodplain have been designated "NV" not valid on the sample data tables. Acetone was used as a field decontamination solvent. As such any results for acetone cannot be considered a valid indication that the compound is indigenous to samples.

- 4,4'-DDD and related compounds (4,4'-DDT and 4,4'-DDE) were confirmed by GC/MS for several samples taken from the floodplain area. Other low-level results were identified only by gas chromatography on dual GC columns. In itself the GC identifications cannot be considered confident. However, since GC/MS confirmations were obtained, the GC results were evaluated in detail and should be considered confident for establishing the extent of contamination.

- The reported result for beta-BHC in the solid sample Weir #4 (TR 1475) cannot be considered confident and has been to designated "NC" in the sample data tables. This compound has not be confirmed by GC/MS. Therefore, it was identified only by a single peak response and dual GC columns. The method of analysis by GC is susceptible to false positives due to random chromatographic interferences particularly for early elating compounds like beta-BHC.

- The laboratory did not report the trace levels of PCB 1254 which are confidently present in samples FP004 at an estimated concentration of 0.042 mg/kg and FP001 at an estimated concentration of 0.048 mg/kg. Examination of the GC chromatogram for these samples revealed the characteristic multi-peak response that is indicative of PCBs. Enough information (extraction weights, volumes, etc.) were present for the reviewer to quantitate these results. The laboratory has been requested to resubmit the analysis report forms for these results. The sample data table has been modified to reflect these additions.

- Due to a laboratory software problem all results reported with a "J" (under the quantitation limit) were reported as positive on the "as received" analysis report form but not detected on the "dry weight basis" analysis report form. The reviewer has manually dry weight corrected these results and incorporated them into the sample data tables. The laboratory has been requested to rectify this problem.

- The reported detection limit for 2-butanone is unreliable and may be substantially higher than reported in samples Weir #4 (TR 1475), stripper effluent (TR 1479), stripper influent (TR 1478) and Weir #4 (TR 1482). This is because examination of the associated calibration standards revealed response factors for 2-butanone that were less than 0.05. Response factors such as these indicate a lack of sensitivity for this compound.

- The reported detection limits for benzidine, 3-nitroaniline, and 4-nitroaniline are unreliable and may be substantially higher than reported for samples FP-001, through FP-009, and BA-001C through BA-015. The associated calibration standard has unacceptable response factors (less than 0.05) for these compounds.

- It should be noted that the analyses of total organic carbon (TOC) does not provide an indication of the presence of volatile organic compounds. With the analytical method that is used to analyze TOC, the sample is purged with nitrogen to liberate all inorganic species of carbon (i.e., biocarbonates). During this purging, light volatile organic compounds are also liberated. Therefore, the parameter "total" organic carbon cannot be considered an absolute.

- Tentatively identified compounds of confident mass spectral matching quality which are not suspected/demonstrated laboratory artifact/contaminants are presented on the attached sample data tables.

SECTION 2

INORGANIC DATA

2.1 Introduction

The inorganic analyses of 3 aqueous samples and 11 solid samples were performed by Lancaster Laboratories. The analysis of one solid sample was performed by CompuChem Laboratories of Research Triangle Park, North Carolina. These samples were analyzed using EPA approved methodologies for Task I and II metals. The findings offered in this report are based upon a detailed review of all available documentation of sample data, holding times, blank results, matrix spike recoveries, quantitation of positive results, calibration and detection limits.

The inorganic analysis was performed acceptably with the exception of a few minor problem requiring several qualifying statements.

2.2 Qualifiers

- Due to the presence of zinc and cadmium in several laboratory and/or trip blanks, the presence of these constituents in the following samples is qualitatively questionable. This has been indicated with a "B" on the sample data tables.

- Many trace level results were reported in samples (and blanks) by the laboratory at concentrations substantially below those demonstrated by available instrumentation. Examination of the absorbance values provided for the calibration standards revealed that concentrations which correspond to absorbance values substantially below 0.003 were in some cases reported as positive results. Absorbance measurements below this (0.003) cannot be discerned from "instrument noise". Concentrations which have been reported in samples deemed to be below these instrument detection limits have been removed from the sample data tables. Furthermore, concentrations reported in blanks below these instrument detection limits were not used to question results clearly above demonstrated instrument sensitivity.

Listed below are the best achievable detection limits which correspond to 0.003 absorbance:

Constituent	Best Achievable Detection Limit
aluminum	100 ug/l
antimony	10 ug/l
arsenic	11 ug/l
barium	100 ug/l
beryllium	10 ug/l
cadmium	3 ug/l
chromium	10 ug/l
cobalt	20 ug/l
copper	30 ug/l
iron	40 ug/l
lead	10 ug/l
manganese	10 ug/l
mercury	0.6 ug/l
nickel	40 ug/l
selenium	10 ug/l
silver	15 ug/l
thallium	15 ug/l
tin	300 ug/l
vanadium	100 ug/l
zinc	10 ug/l

- The reported concentrations of iron in samples BA-001C through BA-015 should be considered estimated. Poor laboratory duplicate precision was reported for iron in the laboratory duplicate analysis for the soil matrix. A "J" has been placed next to these results for iron on the sample data tables.

- The actual detection limits for selenium may be slightly higher than reported for samples BA-001C through BA-015. A low recovery was obtained for the matrix spike constituent selenium in the solid matrix associated with these samples.

- The actual detection limit for selenium in the Weir #4 (TR 1475) may be substantially higher than reported due to a zero matrix spike recovery for this constituent.

- The actual concentrations of arsenic, barium, and lead in sample Weir #4 (TR 1475) may be higher than reported. Poor matrix spike recoveries were obtained for these constituents for the solid matrix. This has been indicated with a "J" on the sample data tables.

- The reported concentrations of copper, magnesium and vanadium in sample Weir #4 (TR 1475) should be considered

estimated. Examination of the ICP serial dilution resulted in high percent differences for the aforementioned constituents. This has been designated with a "J" next to these results on the sample data tables.

SECTION 3

SUMMARY

The attached quality assurance review has identified several aspects of the analytical data that have required qualifying statements. A detailed support documentation contains specific details on this quality assurance review.

Report prepared by:

Rock J. Vitale
QA/QC Manager

7/24/87
Date

TYSON'S SITE

WATER SAMPLE RESULTS

HSL ORGANIC COMPOUNDS

(Concentration in mg/L)

COMPOUNDS	BA-001C 5/11/87	BA-002C 5/11/87	BA-003C 5/11/87	BA-004C 5/11/87	BA-005C 5/11/87	BA-006C 5/11/87	BA-007C 5/11/87	BA-008C 5/11/87	BA-009 5/11/87	BA-010 5/11/87	BA-011 5/11/87	BA-012 5/11/87	BA-013 5/11/87	BA-014 5/11/87	BA-015 5/11/87
VOLATILES															
1,2,3-Trichloropropene	0.012	0.073	0.028	0.029					0.005	0.004 J	0.018	0.006			
Acetone		0.003 NV		0.03 NV	0.7 NV	0.004 NV	0.23 NV	0.005 NV		0.07 NV	0.005 NV	0.08 NV	0.004 NV	0.004 NV	
Chloroethane															
Chloroform	0.003 B		0.003 B	0.002 B			0.002 B								
4-Methyl-2-pentanone										0.002 J					
Toluene										0.009					
Chlorobenzene										0.002 J					
Ethylbenzene										0.002 J					
Total xylenes		0.011					0.004 J			0.052					
SEMI - VOLATILES															
Phenol										0.008 J					
1,4-Dichlorobenzene		0.006 J								0.010					
1,2-Dichlorobenzene		0.005 J								0.007 J					
4-Methylphenol										0.100					
Butylbenzyl phthalate			0.005 B												
Bis (2-ethylhexyl) phthalate										0.008 B				0.01 B	

Qualifier Codes:

NV - The results for acetone are not valid since this was used as a field decontamination solvent.
B - This result is of questionable qualitative significance since this compound was also detected in blank(s).
J - This result should be considered a quantitative estimate.
Blank = None detected

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QA/QC MANAGER 7/23/87 DATE

TYSON'S SITE

WATER SAMPLE RESULTS

HSL PESTICIDES

(Concentration in mg/L)

COMPOUNDS	BA-001C 5/11/87	BA-002C 5/11/87	BA-003C 5/11/87	BA-004C 5/11/87	BA-005C 5/11/87	BA-006C 5/11/87	BA-007C 5/11/87	BA-008C 5/11/87	BA-009 5/11/87	BA-010 5/11/87	BA-011 5/11/87	BA-012 5/11/87	BA-013 5/11/87	BA-014 5/11/87	BA-015 5/11/87
DDE			0.00005 J												
DDD			0.0001												
PCB-1248											0.0002				0.0002
											0.0035				

Blank = None detected

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TYSON'S SITE

WATER SAMPLE RESULTS

TENTATIVELY IDENTIFIED COMPOUNDS

(all concentrations estimated in mg/L)

COMPOUNDS	BA-001C 5/11/87	BA-002C 5/11/87	BA-003C 5/11/87	BA-004C 5/11/87	BA-005C 5/11/87	BA-006C 5/11/87	BA-007C 5/11/87	BA-008C 5/11/87	BA-009 5/11/87	BA-010 5/11/87	BA-011 5/11/87	BA-012 5/11/87	BA-013 5/11/87	BA-014 5/11/87	BA-015 5/11/87
total unknowns	0.029 J	0.34 J	0.18	0.057 J	0.048 J	0.022 J	0.029 J		0.014 J	0.114 J	0.140 J	0.014 J	0.087 J	0.029 J	0.080 J
total hydrocarbons	0.058 J	0.14 J	0.094 J												
4-trichloropropane isomer	0.007 J	0.048 J	0.018 J	0.016 J											
2,3-dichloro-1-propanol		0.009 J							0.005 J		0.015 J				
2-methyl butanoic acid										0.006 J					
benzene acetic acid										0.087 J					
cyanomethyl benzene isomer										0.038 J					
methyl-1,4-indole										0.007 J					
1,3-dihydro-2,4-indol-2-one										0.021 J					

Blank – None detected

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TYSON'S SITE
WATER SAMPLE RESULTS
HSL INORGANIC CONSTITUENTS
(Concentration in mg/L)

CONSTITUENTS	BA-001C 5/11/87	BA-002C 5/11/87	BA-003C 5/11/87	BA-004C 5/11/87	BA-005C 5/11/87	BA-006C 5/11/87	BA-007C 5/11/87	BA-008C 5/11/87	BA-009 5/11/87	BA-010 5/11/87	BA-011 5/11/87	BA-012 5/11/87	BA-013 5/11/87	BA-014 5/11/87	BA-015 5/11/87
Aluminum						0.2	0.2	0.1	0.1	0.1	0.2		0.2	6.8	
Arsenic										0.011					
Barium	0.2	0.2		0.1	0.3	0.1	0.2		0.2	0.4		0.2	0.2	0.1	
Chromium															0.01
Iron		0.87 J	0.43 J	0.33 J	0.57 J	0.18 J	4.9 J	0.25 J	0.83 J	16.4 J	0.42 J	5.15 J	1.85 J	1.5 J	1.4 J
Manganese	1.33 J	0.65	0.02	0.68	3.75	1.55	1.38	0.05	0.54	0.67	0.18	0.76	2.64	2.78	0.64
Zinc	0.04 B	0.02 B	0.02 B	0.010 B	0.020 B	0.020 B	0.03 B	0.010 B	0.04 B	0.020 B	0.02 B	0.02 B	0.02	0.08 B	

Qualifier Codes:
B - This result is of questionable qualitative significance since this constituent was also detected in blank(s).
J - This result should be considered a quantitative estimate.

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AR301261

TYSON'S SITE
SOIL SAMPLE RESULTS
TENTATIVE IDENTIFIED COMPOUND
(concentation in mg/kg ,dry wt. basis)

SAMPLE	WEIR #4
TRAFFIC REPORT	1475
DATE SAMPLED	6/17/87
VOLATILE COMPOUNDS	
1-Propene	0.024
SEMIVOLATILE COMPOUNDS	
Hexadecanoic acid	0.40 J
Aliphatic hydrocarbon	52
Total unknowns	16.3 J

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TYSON'S SITE
FLOODPLAIN SOIL SAMPLE RESULTS
HSL ORGANIC COMPOUNDS
(concentation in mg/kg ,dry wt. basis)

SAMPLE	WEIR #4
TRAFFIC REPORT #	1475
DATE SAMPLE	6/17/87
Volatile	
Methylene Chloride	0.280 B
Acetone	0.068 B
Chloroform	0.011 J
Semi-volatile	
1,2-Dichlorobenzene	0.100 J
1,4-Dichlorobenzene	0.100 J
1,2,4-Trichlorobenzene	0.170 J
Phenanthrene	0.300 J
Fluoranthene	0.480 J
Pyrene	0.530 J
Benzo (a) anthracene	0.320 J
bis(2-ethylhexyl) phthalate	0.260 B
Chrysene	0.370 J
Benzo (b) fluoranthene	0.290 J
Benzo(k)fluoranthene	0.270 J
Benzo (a) pyrene	0.320 J
Indeno (1,2,3-cd) pyrene	0.170 J
PCB's and Pesticides	
Beta-BHC	0.031 NC
4,4'-DDE	0.079
4,4'-DDD	0.22

Qualifier Codes:
J: This result should be considered a quantitative estimate.
B: This result is of questionable qualitative significance since this compound was detected in blanks(s) at similar concentrations.
NC: This result cannot be considered confident.

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TYSON'S SITE
WATER SAMPLE RESULTS
HSL ORGANIC COMPOUNDS

(Concentration in mg/L)

Sample Description Traffic Report # Date Sampled	Stripper Effluent 1479 6/17/87	Stripper Effuent Duplicate 1481 6/17/87	Stripper Influent 1478 6/17/87	Stripper Effuent Duplicate 1481 6/17/87	Weir 4 1482 6/17/87
VOLATILES					
Tetrachloroethene			0.0012 J		
1,2,3-Trichloropropane	0.18	0.15	0.17	0.15	0.014
Carbon disulfide					0.0054
SEMI - VOLATILES	ND	ND	NA	NA	ND
PESTICIDE/PCBS	ND	ND	NA	NA	ND
TENTATIVELY IDENTIFIED COMPOUNDS					
3,3-Dichloropropene	0.014 J	ND	ND	ND	ND

Qualifier Codes:

J - This result should be considered a quantitative estimate.
Blank and ND= None detected
NA - Not analysis

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AR301264

TYSON'S SITE
FLOODPLAIN AREA SOIL SAMPLES
INORGANIC CONSTITUENTS
March, 1987
(concentrations in ppm, dry wt. basis)

CONSTITUENT*	FP-001	FP-002	FP-003	FP-004	FP-005	FP-006	FP-007	FP-008	FP-009
ALUMINUM	4410.	11000.	17000.	8030.	N/A	N/A	N/A	N/A	N/A
ARSENIC	4.93	5.98	9.08	4.72	N/A	N/A	N/A	N/A	N/A
BARIUM	82.7	93.8	188	91.3	N/A	N/A	N/A	N/A	N/A
BERYLLIUM	0.29	0.54	0.96	0.63	N/A	N/A	N/A	N/A	N/A
CADMIUM		0.41 B	2.23	0.79	N/A	N/A	N/A	N/A	N/A
CHROMIUM	8.7	19.0	57.3	20.5	N/A	N/A	N/A	N/A	N/A
COBALT	4.4	12.2	31.8	11.0	N/A	N/A	N/A	N/A	N/A
COPPER	23.2	28.5	78.0	40.9	N/A	N/A	N/A	N/A	N/A
IRON	11600.	16300	26900	13300	N/A	N/A	N/A	N/A	N/A
LEAD	47.9	72.0	104	55.1	N/A	N/A	N/A	N/A	N/A
MANGANESE	437.	457	1470	466.	N/A	N/A	N/A	N/A	N/A
NICKEL	7.3	16.3	49.4	17.3	N/A	N/A	N/A	N/A	N/A
SELENIUM		1.36	2.07	0.94	N/A	N/A	N/A	N/A	N/A
SILVER			0.48		N/A	N/A	N/A	N/A	N/A
VANADIUM	4.4	25.8	38.2	14.2	N/A	N/A	N/A	N/A	N/A
ZINC	61.1	115	291	156.	N/A	N/A	N/A	N/A	N/A
TOC	12,000	23,000	24,000	13,000	6,500	9,600	17,000	6,500	15,000

Qualifier Codes:

B: This result is of questionable qualitative significance since this constituent was detected in blanks(s) at similar concentrations.

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TYSON'S SITE
FLOODPLAIN AREA SOIL SAMPLES
TENTATIVELY IDENTIFIED COMPOUNDS
March, 1987
(all concentrations estimated in mg/kg)

	FP-001	FP-002	FP-003	FP-004
total alphatic hydrocarbons	2.7 J	3.1 J		0.5 J
total unknowns	20.9 J	5.7 J	7.7 J	3.8 J
methyl-benzenesulfonamide isomers			0.97 J	0.80 J
hexadecanoic acid	0.93 J	2.9 J	0.17 J	1.3 J
1-methyl naphthalene	0.60 J			0.4 J
dimethyl naphthalene isomer	1.2 J			
tetradecanoic acid	0.575			
a methyl phenanthrene isomer		7.6 J		
9,10-anthracenedione		0.77 J		
12-methyl benzo(a) anthracene		0.73 J		

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TYSON'S SITE
FLOODPLAIN AREA SOIL RESULTS
HSL ORGANIC COMPOUNDS
MARCH, 1987 (ppm,dry wt. basis)

	FP-001	FP-002	FP-003	FP-004
Volatile				
1,2,3-Trichloropropane	0.040		0.037	0.037
Methylene Chloride	0.061 B	0.034 B	0.056 B	0.016 B
Acetone	0.087 B		0.032 B	0.010 B
1,1,1-Trichloroethane	0.077	0.023	0.030	0.049
Tetrachloroethene	0.005		0.018	0.005
Toluene	0.013	0.022	0.110	0.014
Total xylenes	0.009		0.022	
Ethylbenzene			0.007 J	
Trichloroethene	0.007			
Semi-volatile				
Naphthalene	0.67	0.64		0.33 J
2-Methylnaphthalene	0.96	0.41 J		0.50 J
Acenaphthylene	0.27 J			
Dibenzofuran	0.43 J	0.54		
Acenaphthene	0.27 J			
Fluorene		0.72		
1,2,4-Trichlorobenzene			0.64	0.50 J
Phenanthrene	0.96	3.67		0.50 J
Anthracene	0.30 J	1.09		
Fluoranthene	1.06	4.66	0.32	0.50 J
Pyrene	0.96	5.01	0.48	0.58
Benzo (a) anthracene	0.50 J	3.34		
Chrysene	0.81	3.03		0.33 J
Benzo (b) fluoranthene	1.44	4.61		
Benzo (a) pyrene	0.43 J	2.62		
Indeno (1,2,3-cd) pyrene		1.40		
Benzo (ghi) perylene		1.49		
Dibenzo(ah)anthracene	0.27 J			
PCB's and Pesticides				
PCB-1254	0.046 J		0.14 J	0.042 J
PCB-1260			0.16 J	

Qualifier Codes:
J: This result should be considered a quantitative estimate.
B: This result is of questionable qualitative significance since this compund was detected in blanks(s) at similar concentrations.

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AR301267

SCHUYLKILL RIVER BOTTOM WATER RESULTS
HSL INORGANIC CONSTITUENTS AND ORGANIC COMPOUNDS
(Concentration in mg/l)

COMPOUND	Station A	Station B	Station C	Station D	Station E	Station F	Station G	Station H	Station I	Station J	Station K
VOLATILES											
ACETONE	0.002 B	0.002 B			0.002 B			0.002 B			0.003 B
METHYLENE CHLORIDE	0.003 B	0.003 B	0.003 B	0.003 B	0.003 B	0.002 B	0.003 B	0.009 B	0.002 B	0.002 B	0.002 B
INORGANIC COMPOUNDS											
ALUMINUM	NA	NA	NA	NA	NA	NA	0.8	0.4	NA	NA	0.3
ANTIMONY	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	ND
ARSENIC	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	ND
BARIUM	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	ND
BERYLLIUM	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	ND
CADMIUM	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	ND
CHROMIUM	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	ND
COPPER	NA	NA	NA	NA	NA	NA	0.03 J	ND	NA	NA	ND
IRON	NA	NA	NA	NA	NA	NA	0.68	0.60	NA	NA	0.47
LEAD	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	ND
MANGANESE	NA	NA	NA	NA	NA	NA	0.17	0.15	NA	NA	0.14
MERCURY	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	ND
NICKEL	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	ND
SELENIUM	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	ND
SILVER	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	ND
TIN	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	ND
VANADIUM	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	ND
ZINC	NA	NA	NA	NA	NA	NA	0.04	0.03	NA	NA	0.04
THALLIUM	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	ND
SEMI-VOLATILE ORGANICS	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA	ND
PCB'S/PESTICIDES	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA	ND

NOTES:
NA: Not analyzed
ND and blank spaces: None detected
Qualifier Codes:
B: This result is of questionable qualitative significance since this compound/constituent was detected in blanks(s) at similar concentrations.
J: This result should be considered a quantitative estimate.

TYSON'S SITE
FLOODPLAIN AREA SEDIMENT SAMPLE RESULTS
INORGANIC CONSTITUENTS
(concentration in mg/kg; dry weight basis)

Sample Description	Weir #4
Traffic report number	1475
CONSTITUENTS	
Aluminum	7130
Arsenic	10 J
Barium	225 J
Beryllium	1.3
Calcium	2520
Chromium	31
Cobalt	19
Copper	71
Iron	18400
Lead	65 J
Magnesium	1850
Manganese	1060
Mercury	0.29
Nickel	26
Vanadium	18 J
Zinc	251
Percent Solids	42

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TYSON'S SITE
QUALITY ASSURANCE REVIEW

24 July 1987

Environmental Resources Management, Inc.
999 West Chester Pike
West Chester, Pennsylvania 19382

TABLE 1

ERM Sample #	Lancaster Sample #
BA-001 S	1160105
BA-002 S	1160106
BA-003 S	1160107
BA-004 S	1160111
BA-005 S	1160112
BA-006 S	1160113
BA-007 S	1160114

TABLE 2

METHODOLOGY SUMMARY

Analysis for Moisture.

A well-mixed sample is placed in a weighed beaker and dried to constant weight in an oven at 103 to 105C. The decrease in weight of the sample is the Moisture.

Analysis for Aluminum, Antimony, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Nickel, Silver, Vanadium, Zinc, and Thallium in Soils.

The sample is prepared according to EPA SW 846, Method 3050. The organic material is oxidized and the metals dissolved with Nitric acid, Hydrogen Peroxide, and Hydrochloric acid. The sample analyzed by Flame Atomic Absorption.

Analysis for Arsenic and Selenium in Soils.

The sample is prepared by digestion with Nitric and Sulfuric acids. The analysis is performed by Hydride Generation Atomic Absorption.

Analysis for Mercury in Soils.

The sample is digested with Aquaregia and Potassium Permanganate at 95°C. The analysis is performed by Cold Vapor Atomic Absorption.

Analysis for Total Organic Carbon.

Following acidification, the sample is purged with nitrogen to remove inorganic carbon. Persulfate is injected to oxidize organic carbon to CO_2 which is detected by IR. 01 Model 700 TOC Analyzer is used.

Analysis for HSL Volatiles by GC/MS in Soil.

The volatiles in the sample are extracted with methanol. The resulting extract is purged with Helium and the volatiles are collected on a Tenax-Silica gel trap. The trap is desorbed onto the GC column where components of the sample are separated and then onto the mass spectrometer for spectral evaluation.

Analysis for HSL Semi-Volatiles.

The sample is solvent extracted and the extract is analyzed by GC/MS.

Analysis for HSL Pesticides.

Pesticides are extracted with a sonic prob and acetone-methelene chloride. The extract is exchanged with hexane, concentrated and florisiled to minimize interferences.

Analysis for Particle Size Mesh (Wet Seiving).

About 50 grams of sample is carefully weighted into a 250 mg beaker. The sample is transferred to the desired stack of sieves with as much water as needed to complete the transfer. The insoluble particles are washed through the sieve is transferred to tared 250 ml beakers using water to complete the transfer. Beaders are dried in a 100c oven and weighed. The residue collected from each sieve is calculated as a percentage of the original sample.

TABLE 3

METHOD REFERENCES

Analysis	Reference
Moisture	EPA 600/4-79-020, Method 160.2
Aluminum	EPA SW 846 2nd ed. 1984, Method 3050 Adapted
Antimony	EPA SW 846 2nd ed. 1984, Method 7040
Arsenic	EPA SW 846 2nd ed. 1984, Method 7061
Barium	EPA SW 846 2nd ed. 1984, Method 7080
Beryllium	EPA SW 846 2nd ed. 1984, Method 7090
Cadmium	EPA SW 846 2nd ed. 1984, Method 7130
Chromium	EPA SW 846 2nd ed. 1984, Method 7190
Cobalt	EPA SW 846 2nd ed. 1984, Method 3050 Adapted
Copper	EPA SW 846 2nd ed. 1984, Method 7210
Iron	EPA SW 846 2nd ed. 1984, Method 7380
Lead	EPA SW 846 2nd ed. 1984, Method 7420
Manganese	EPA SW 846 2nd ed. 1984, Method 7561
Mercury	EPA SW 846 2nd ed. 1984, Method 7471
Nickel	EPA SW 846 2nd ed. 1984, Method 7520
Selenium	EPA SW 846 2nd ed. 1984, Method 7741
Silver	EPA SW 846 2nd ed. 1984, Method 7760
Vanadium	EPA SW 846 2nd ed. 1984, Method 3050 Adapted
Zinc	EPA SW 846 2nd ed. 1984, Method 7950
Thallium	EPA SW 846 2nd ed. 1984, Method 7840
Total Organic Carbon	EPA 600/4-79-020, Method 415.2
HSL Volatiles	USAEPA Contract Lab Program May, 1984, Revised July, 1985. IFB WA85-J176, J177, J178.
HSL Semi-Volatiles	USAEPA Contract Lab Program May, 1984 Revised July, 1985. IFB WA85-J176, J177, J178.
HSL Pesticides	USAEPA Contract Lab Program May, 1984, Revised July, 1985. IFB WA85-J176, J177, J178.

TYSONS' SITE
QUALITY ASSURANCE REVIEW

The following quality assurance report is based upon a review of the data generated from the floodplain area sediment samples presented on Table 1. A summary of the methods and method references are presented on Table 2 and 3, respectively.

This review was performed in accordance with the Functional Guidelines for Evaluating Organic and Inorganic Analyses (USEAP).

1.0 Organic Data

1.1 Introduction

The organic analyses of 7 floodplain area sediment samples were performed by Lancaster Laboratories of Lancaster, Pennsylvania. these samples were analyzed using EPA methodologies for percent moisture by weight, total organic carbon, particle size mesh (wet serving), pH, target compound list (TCL) volatile compounds and, additional compound, 1,2,3-trichloropropane, acid/base/neutral extractable TCL compounds, tentatively identified compounds for the volatile and semivolatile fractions, and TCL pesticides/PCB's. The findings offered in this report are based upon a detailed review of all available documentation of sample data, holding times, blank results, surrogate and matrix spike recoveries, evaluation of GC results, target compound matching quality, instrument tuning, calibration/quantitation and tentatively identified compounds.

In general, the organic analyses of the aforementioned sediment samples were performed acceptably with the exception of a few problems requiring several qualifying statements.

1.2 Qualifiers

- Due to the low level presence of methylene chloride, benzene, toluene and di-n-butyl phthalate in a method or trip blank, the presence of these compounds in the following samples is qualitatively questionable. This has been indicated with a "B" next to these reported results on the attached sample data tables.

Compound	Samples with Questionable Results
methylene chloride	All positive sample results
benzene	BA-002S
toluene	BA-005S
di-n-butyl phthalate	BA-007S

- The reported results for acetone in all samples should be considered not valid (NV) due to the fact that acetone was used as a decontamination solvent thus, the reported concentrations of this compound cannot be considered indigenous to any samples.

- The concentration of 1,2,3-trichloropropane in samples BA-001S, BA-002S, BA-003S, and BA-004S were reported on the "as received" analysis report forms but not reported on the "dry weight corrected" analysis report forms. The reviewer has incorporated them into the sample data tables. The laboratory has been informed of this error and is resubmitting the "dry weight corrected" results for 1,2,3,-trichloropropane.

- Due to a problem with the laboratory reporting software, positive results reported as a "J" value on the "as received" laboratory reporting forms were reported as "not detected" on the "dry weight corrected" laboratory reporting forms. The reviewer has dry weight corrected these results and has incorporated them into the sample data tables. The laboratory has been informed of this problem and is attempting to correct the software programming.

- For sample BA-006S the reconstructed ion chromatogram (RIC), quantitation list nor the mass spectrum for chloroethane were provided in the data. The laboratory has been made aware of this and the RIC, quantitation list, and mass spectrum have been requested.

- For sample BA-003S, 4,4'-DDD was confirmed by a GC/MS library search. In addition, several low level results for DDD and related compounds (DDE and DDT) were identified in other samples by dual column GC procedures. Due to the GC/MS confirmation of DDD in sample BA-003S, the reported results for DDD and related compounds identified by GC can be used to establish the extent of contamination.

- In sample BA-004S the laboratory neglected to report a positive result for PCB-1254. Examination of the dual column chromatograms revealed the unique multipeak pattern for PCB 1254. Sufficient information was present which enabled the reviewer to quantitate this result. This result has been incorporated into the data tables.

- In sample BA-005S the laboratory reported an incorrect concentration of 300 mg/kg for PCB-1254. The corrected result of 0.3 mg/kg has been incorporated into the sample data table and the laboratory is resubmitting the corrected result for this sample.

- The detection limits for alpha-BHC, gamma-BHC, beta-BHC, heptachlor, delta-BHC, aldrin, heptachlor epoxide, and endosulfan I for samples BA-002S, BA-004S, BA-005S, BA-006S, and BA-007S may be higher than reported. Examination of the GC chromatograms for these revealed that the ECD detector was saturated for approximately the first 9.5 minutes. As a result, the resolution of pesticide peaks (if present) could not be ascertained.

- The actual detection limits, and/or positive results for 3-nitroaniline, benzidine, and 2-butanone in all samples are unreliable and may be substantially higher than reported. This is because examination of the associated initial 5 point calibrations and the continuing 50 ppb calibrations revealed response factors for these compounds of less than 0.05. Response factors such as these indicate a lack of sensitivity for these compounds. Due to this, the positive results for 2-butanone in samples BA-002S, BA-004S and BA-005S have been flagged as estimated values (J) on the sample data tables.

2.0 Inorganic Data

2.1 Introduction

The inorganic analyses of 7 floodplain area sediment samples were performed by Lancaster Laboratories. These samples were analyzed using EPA approved methodologies for Task 1 and Task 2 metals. The findings offered in this report are based upon a detailed review of all available documentation of sample data, holding times, blank results, matrix spike recoveries, duplicate analyses, quantitation of positive results, calibration, and detection limits.

In general, the inorganic analyses performed acceptably with the exception of a few problem requiring several qualifying statements.

2.2 Qualifiers

- Due to the low level presence of beryllium, selenium, and thallium in method blanks, the presence of these constituents in the following samples is qualitatively questionable. This has been indicated with a "B" next to the reported results on the attached sample data tables.

Constituents	Samples with Questionable Results
beryllium	BA-001S and BA-006S
selenium	BA-001S, BA-004S, BA-005S, BA-006S and BA-007S
thallium	All positive sample resu

- Several trace level results were reported in samples (and blanks) by the laboratory at concentrations substantially below those demonstrated by available instrumentation. Examination of the absorbance values provided for the calibration standards revealed that concentrations which correspond to absorbance values substantially below 0.003 were in some cases reported as positive results. Absorbance measurements below this (0.003) cannot be discerned from "instrument noise". Concentrations which have been reported in sampled deemed to be below these instrument detection limits have been removed from the sample data tables. Furthermore, concentrations reported in blanks below these instrument detection limits were not used to question results clearly above demonstrated instrument sensitivity.

  Listed below are the best achievable detection limits which correspond to 0.003 absorbance:

Constituent	Best Achievable Detection Limit
Aluminum	100 ug/l
Antimony	10 ug/l
Arsenic	11 ug/l
Barium	100 ug/l
Beryllium	10 ug/l
Cadmium	3 ug/l
Chromium	10 ug/l
Cobalt	20 ug/l
Copper	30 ug/l
Iron	40 ug/l
Lead	10 ug/l
Manganese	10 ug/l
Mercury	0.6 ug/l
Nickel	40 ug/l
Selenium	10 ug/l
Silver	15 ug/l
Thallium	15 ug/l
Tin	300 ug/l
Vanadium	100 ug/l
Zinc	10 ug/l

3.0 Summary

The attached quality assurance review has identified several aspects of the analytical data that have required qualifying statements. A detailed support documentation contains specific details on this quality assurance review.

Report Prepared By:

Christine M. Jaeceko — Date

Report Reviewed By:

Rock J. Vitale — 7/27/87.
Date

TYSONS SITE
FLOODPLAIN AREA SEDIMENT SAMPLE RESULTS
HSL ORGANIC COMPOUNDS
(Concentration in mg/kg, dry wt. basis)

COMPOUNDS	BA-001S 5/11/87	BA-002S 5/11/87	BA-003S 5/11/87	BA-004S 5/11/87	BA-005S 5/11/87	BA-006S 5/11/87	BA-007S 5/11/87
VOLATILES							
1,2,3-Trichloropropane	0.017	0.065	0.183	0.007			
Methylene chloride	0.004 B	0.016 B		0.027 B	0.007 B	0.004 B	
Acetone	0.024 NV	0.44 NV	0.030 NV	1.000 NV	0.082 NV	0.025 NV	0.270 NV
trans- 1,2-Dichloroethene		0.071		0.019			
2-Butanone		0.110		0.010 J	0.010 J		0.053
Trichloroethene				0.009			
4-Methyl-2-pentanone		0.055					
Tetrachloroethene	0.004 J		0.011 J	0.004 J			
Toluene		0.980			0.003 B		0.110
Chlorobenzene		0.280					0.053
Ethylbenzene		0.490					0.110
Total xylenes		7.100		0.021			1.000
Vinyl chloride		0.016 J					
Benzene		0.011 B					
Chloroethane						0.004 J	
SEMI- VOLATILES							
1,2,4-Trichlorobenzene		3.10					
1,2-Dichlorobenzene		2.00 J					0.80 J
1,4-Dichorobenzene		3.60					
4-Methylphenol		14.00			1.30		
Benzo (a) anthracene				0.30 J	1.35	0.38 J	
Benzo (a) pyrene	0.26 J				1.14	0.38 J	
Benzo (b) fluoranthene	0.26 J			0.30 J	2.17	0.80	
Chrysene	0.40 J			0.45 J	1.47	0.51	
Fluoranthene	0.67			0.85	3.26	1.11	0.53 J
Phenanthrene	0.71			0.64	2.28	0.89	0.53 J
Pyrene	0.53			0.64	2.45	0.80	
1,3-Dichlorobenzene		1.09 J					
Benzoic acid		1.63 J					
Naphthalene				0.30 J	0.33 J		
2-Methyl naphthalene				0.30 J	0.49 J		
Benzo(k)fluoranthene				0.30 J			
2,4-Dimethylphenol					0.33 J		
Dibenzofuran					0.33 J		
Fluorene					0.33 J		
Anthracene					0.49 J		
Indeno(1,2,3-cd)pyrene					0.49 J		
Benzo(ghi)perylene					0.49 J		
Di-n-butyl phthalate							0.53 B

Qualifier Codes:
J: This result should be considered a quantitative estimate.
B: This result is of questionable qualitative significance since this constituent was detected in blanks(s) at similar concentrations.
NV: The results for acetone are not valid if was used for a decontamination solvent.

TYSON'S SITE
FLOODPLAIN AREA SEDIMENT SAMPLE RESULTS
TENTATIVELY IDENTIFIED COMPOUNDS
(concentration in mg/kg)

	BA-001S 5/11/87	BA-002S 5/11/87	BA-003S 5/11/87	BA-004S 5/11/87	BA-005S 5/11/87	BA-006S 5/11/87	BA-007S 5/11/87
SEMIVOLATILE FRACTION							
1-Propene, 2,3-dichloro-		0.70 J					9.30 J
4H-Cyclopenta[def] phenanthrene					0.50 J	0.20 J	
Aliphatic hydrocarbon	0.30 J						
Cyclopropane, 1,1,2,2-tetramethyl-			0.50 J				
Fatty acid							1.60 J
Heptacosane		0.90 J	0.30 J		0.05 J		
Heptadecane					0.80 J		
Heptadecane, tetramethyl-isomer	0.30 J						
Hexane, bromo-isomer				0.50 J			
Hexanedioic acid, ester cl	0.50 B					0.50 B	
Hexatriacontane		1.3 J		1.10 J	0.90 J		
Hydroxylamine, O-(3-methylbutyl)-	0.80 J						
Isothiazole, methyl-isomer						0.40 J	
Octacosane				0.40 J			
p,p'-DDD			0.07 J				
Pentane isomer						0.60 J	
Propene, trichloro-isomer	0.60 J	0.90 J	1.30 J	5.70 J			
Tetradecanoic acid					0.70 J	0.30 J	
Total Unknowns	4.9 J	5.9 J	12.50 J	17.20 J	3.90 J	4.00 J	28.00 J
VOLATILE FRATION							
Chloro-1-propene isomer		0.0053					
Methylcyclopentane isomer		0.011 J					
1, 5-Hexadiene		0.137 J					0.012 J
Unknown C6 unsaturated hydrocarbon		0.009 J					
Unknown		0.018 J					
1-Propene				0.02 J			0.066 J
1,1,2-Trichloro-1,2,2-trifluoroethane				0.01 J			
Hexane					0.006 J		

Qualifier Codes:
J: This result should be considered a quantitative estimate.

TYSON'S SITE
FLOODPLAIN AREA SEDIMENT SAMPLE RESULTS
GENERAL PARAMETERS
(concentration in mg/kg)

ITEM	UNIT	BA-001S 5/11/87	BA-002S 5/11/87	BA-003S 5/11/87	BA-004S 5/11/87	BA-005S 5/11/87	BA-006S 5/11/87	BA-007S 5/11/87
Moisture	% by wt.	25.2	81.7	63.5	32.9	38.7	21.3	62.3
TOC	mg/kg as received	3300	11000	9700	6400	14000	2300	11000
TOC	mg/kg dry wt. basis	4400	60000	27000	9500	23000	2900	29000
pH	1:1	7.75	6.77	7.03	7.18	6.95	6.97	6.82
Particle Size-mesh 4	% passing	85.79	99.97	98.89	99.46	99.22	99.93	99.03
Particle Size-mesh 8	% passing	75.13	99.62	98.36	97.80	98.75	97.47	98.55
Particle Size-mesh 50	% passing	33.25	98.84	93.50	65.79	81.19	27.87	90.07
Particle Size-mesh 200	% passing	26.70	90.15	83.62	46.85	64.83	22.49	79.52

TYSON'S SITE
FLOODPLAIN AREA SEDIMENT SAMPLE RESULTS
HSL PESTICIDES
(Concentration in mg/kg, dry wt. basis)

COMPOUNDS	BA-001S 5/11/87	BA-002S 5/11/87	BA-003S 5/11/87	BA-004S 5/11/87	BA-005S 5/11/87	BA-006S 5/11/87	BA-007S 5/11/87
DDD		0.279	3.26				2.12
DDE			1.56				1.11
DDT			0.123			0.013 J	0.42
PCB-1254				0.150 J	0.300		
PCB-1260					0.64		

Qualifier Codes:

J: This result should be considered a quantitative estimate.

AR301283

TYSON'S SITE
FLOODPLAIN AREA SEDIMENT SAMPLE RESULTS
HSL INORGANIC CONSTITUENTS
(Concentration in mg/kg, dry wt. basis)

CONSTITUENTS	BA-001S 5/11/87	BA-002S 5/11/87	BA-003S 5/11/87	BA-004S 5/11/87	BA-005S 5/11/87	BA-006S 5/11/87	BA-007S 5/11/87
Aluminum	5480	17100	18400	6410	11900	5120	14400
Arsenic	2.5	13.7	8.2	4.3	5.2	2.6	11.4
Barium	72.2	432	227	106	160	64.8	135
Beryllium	0.40 B	2.2	1.1	0.80	0.70	0.40 B	1.1
Chromium	9.4	27.3	27.4	13.4	14.7	10.2	21.2
Cobalt	4.0	16.4	19.2	6.0	6.5	2.5	10.6
Copper	20.1	98.4	49.3	28.3	24.5	12.7	109
Iron	8680	36100	20900	15800	15200	7850	20000
Lead	22.7	109	126	95.4	55.5	29.2	103
Manganese	229	409	1120	142	462	133	347
Nickel	5.3	21.9	21.9	10.4	8.2	8.9	13.3
Selenium	0.40 B	3	1.9	0.30 B	0.50 B	0.3 B	1.0 B
Vanadium	12.0	60	43.8	11.9	19.6	11.4	37.1
Zinc	77.9	1070	299	69.2	96.1	81.7	182
Cadmium		0.11	0.60	0.20	0.20		0.60
Thallium		3.3 B		0.60 B	1.0 B	0.80 B	1.6 B

Qualifier Codes:
B: This result is of questionable qualitative significance since this constituent was detected in blanks(s) at similar concentrations.

FILE: 272-11(01)

TYSON'S SITE

QUALITY ASSURANCE REVIEW

29 June 1987

Prepared By:

Environmental Resources Management, Inc.
999 West Chester Pike
West Chester, Pennsylvania 19382

TYSON'S SITE

QUALITY ASSURANCE REVIEW

The following quality assurance report is based upon a review of the data generated for the aqueous samples presented on Table 1. A summary of the methods and the method references are presented on Tables 2 and 3, respectively.

This review was performed in accordance with the Functional Guidelines for Evaluating Organic and Inorganic Analyses (USEPA).

1.0 ORGANIC DATA

1.1 Introduction

The organic analysis of 31 aqueous samples was performed by Lancaster laboratories of Lancaster, Pennsylvania. These samples were analyzed using EPA methodologies and the majority were analyzed for volatile priority pollutant/hazardous substance list compounds and one additional volatile compound (1,2,3-trichloropropane). Library searches were conducted for extraneous chromatographic peaks and acid/base/neutral extractable priority pollutant/hazardous substance list compounds; several samples were also analyzed for pesticides/PCBs. The findings offered in this report are based upon a detailed review of all available documentation of sample data, holding times, blank results, surrogate and matrix spike recoveries, evaluation of GC results, target compound matching quality instrument tuning, calibrations/quantitation, and tentatively identified compounds.

In general, the organic analysis of the aforementioned samples was performed acceptably with the exception of a few problems requiring several qualifying statements.

1.2 Qualifiers

- Due to the low level presence of methylene chloride, acetone, 2-butanone, and toluene in trip and/or laboratory blanks during the sample analysis in October of 1986, the presence of these compounds in the following samples is qualitatively questionable. This has been indicated with a "B" next to these reported results on the attached sample data tables.

TABLE 1

ERM Sample #	Analysis Parameters	Lancaster Sample #
	October 1986	
Station A	VOA only	1108153
Station B	VOA only	1108152
Station C	VOA only	1108151
Station D	VOA only	1108150
Station E	VOA only	1108149
Station F	VOA only	1108148
Station G	VOA,Metals,BNA, PCB/Pesticides	1108147
Station H	VOA only	1108155
Station I	VOA only	1108156
	February 1987	
Station A	VOA only	1134564
Station B	VOA only	1134570
Station C	VOA only	1134563
Station D	VOA only	1134562
Station E	VOA only	1134571
Station F	VOA only	1134569
Station G	VOA,BNA,PCB/Pecticides	1134566
Station H	VOA only	1134572
Station I	VOA only	1134565
	March 1987	
Station A	VOA only	1144850
Station B	VOA only	1144849
Station C	VOA only	1144848
Station D	VOA only	1144847
Station E	VOA only	1144858
Station F	VOA only	1144857
Station G	VOA,Metals,BNA, PCB/Pesticides	1144852
Station H	VOA,Metals	1144859
Station I	VOA only	1144851
Station J	VOA only	1144856
	Methanol Rinses	
Rinse 2	VOA only	1142147
Rinse 3	VOA only	1142148
Rinse 4	VOA only	1142151

TABLE 2

METHODOLOGY SUMMARY

Analysis for aluminum, antimony, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, silver, tin, vanadium, zinc, and thallium in water and wastewater.

The sample is prepared by heating with nitric and hydrochloric acids. The analysis is performed by Flame Atomic Absorption.

Analysis for arsenic and selenium in water and wastewater

The sample is acid digested and analyzed by Hydride Generation Atomic Absorption.

Analysis for mercury in water and wastewater

The sample is prepared by heating at 95°C with nitric acid, sulfuric acid, potassium permanganate, and potassium persulfate. The analysis is performed by Cold Vapor Atomic Absorption.

Analysis for HSL Volatiles by GC/MS

The sample is purged with helium and the volatiles are collected on a Tenax/Silica gel trap. The trap is desorbed onto the GC column where components of the sample are separated and then on to the mass spectrometer for spectral evaluation.

Analysis for HSL Semi-Volatiles

The sample is solvent extracted and the extract is analyzed by GC/MS.

Analysis for Pesticides and PCBs

Pesticides are extracted with methylene chloride and hexane. The extract is dried and concentrated, then analyzed quantitatively be gas chromatography. If necessary, florisil and elemental sulfur are used to eliminate interferences.

TABLE 3

METHOD REFERENCES

Analyte	Reference
Moisture	EPA 600/4-79-020, 160.3
Aluminum	EPA SW 846 2nd ed. 1984, Method 3050
Antimony	EPA SW 846 2nd ed. 1984, Method 7040
Arsenic	EPA SW 846 2nd ed. 1984, Method 7061
Barium	EPA SW 846 2nd ed. 1984, Method 7080
Beryllium	EPA SW 846 2nd ed. 1984, Method 7090
Cadmium	EPA SW 846 2nd ed. 1984, Method 7130
Chromium	EPA SW 846 2nd ed. 1984, Method 7190
Cobalt	EPA SW 846 2nd ed. 1984, Method 3050
Copper	EPA SW 846 2nd ed. 1984, Method 7210
Iron	EPA SW 846 2nd ed. 1984, Method 7380
Lead	EPA SW 846 2nd ed. 1984, Method 7420
Manganese	EPA SW 846 2nd ed. 1984, Method 7461
Mercury	EPA SW 846 2nd ed. 1984, Method 7471
Nickel	EPA SW 846 2nd ed. 1984, Method 7520
Selenium	EPA SW 846 2nd ed. 1984, Method 7741
Silver	EPA SW 846 2nd ed. 1984, Method 7760
Tin	EPA SW 846 2nd ed. 1984, Method 3050
Vanadium	EPA SW 846 2nd ed. 1984, Method 3050
Zinc	EPA SW 846 2nd ed. 1984, Method 7950
pH	EPA 600/4-79-020, Method 150.1
Thallium	EPA SW 846 2nd ed. 1984, Method 7840
Volatiles	IFB WA85-176, 177, 178 USAEPA Contract Lab Program
Semi-Volatiles	IFB WA85-176, 177, 178 USAEPA Contract Lab Program
Pesticides/PCBs	IFB WA85-176, 177, 178 USAEPA Contract Lab Program

Compound	Samples with Questionable Results
methylene chloride	All positive sample results
acetone	All positive sample results
2-butanone	F
toluene	C

- Due to the low level presence of methylene chloride in a method blank during the sample analysis in March of 1987, the presence of this compound in the following samples is qualitatively questionable. This has been indicated with a "B" next to these reported results on the attached sample data tables.

Compound	Samples with Questionable Results
methylene chloride	A, H, I, and J

- Due to the low level presence of acetone and 2-butanone in trip and/or laboratory blanks during the sample analysis of the methanol rinses, the presence of these compounds in the following samples is considered qualitatively questionable. This is designated with a "B" next to these reported results on the attached sample data tables.

Compound	Samples with Questionable Results
acetone	All positive results
2-butanone	All positive results

- The actual detection limit for benzidine in sample G for the 1987 February sample analysis is unreliable and may be substantially higher than reported. This is because examination of the associated initial 5 point calibration standard and the associated continuing 50 ppb calibration standard revealed response factors for benzidine that were less than 0.05. Response factors such as these indicate a lack of sensitivity for this compound.

- The actual detection limits for 2-butanone in samples C, D, G, and I for the 1987 February sample analysis are unreliable and may be higher than reported. This is because examination of the associated continuing 50 ppb calibration standard revealed a response factor for 2-butanone that was less than 0.05.

- The actual detection limits for benzidine, 3-nitroaniline, and 4-nitroaniline in sample G of the March 1987 sample analysis may be higher than reported. This is because examination of the associated initial 5 point calibration standard revealed response factors for these compounds of less than 0.05.

- The actual detection limit for 2-butanone in samples A, B, C, D, E, F, I and J for the March 1987 sample analysis is unreliable and may be higher than reported. This is because examination of the initial 5 point calibration standard and the continuing 50 ppb calibration standards revealed response factors of less than 0.05. Response factors such as these indicate a lack of sensitivity for the compound.

- Although the presence of 2-butanone in samples #2, #3, #4 for the methanol rinses is questionable, if 2-butanone is actually present in these samples, the reported concentrations should be considered estimated. This is because examination of the associated continuing 50 ppb calibration standards revealed response factors of less than 0.05. A response factor such as this indicates a problem with instrument stability for 2-butanone.

2.0 INORGANIC DATA

2.1 Introduction

The inorganic analysis of 4 aqueous samples was performed by Lancaster Laboratories. These samples were analyzed using EPA approved methodologies for inorganic priority pollutants and several additional inorganic constituents. The findings offered in this report are based upon a detailed review of all available documentation of sample data, holding times, blank results, matrix spike recoveries, quantitation of positive results, calibrations, and detection limits.

The inorganic analysis was performed acceptably with the exception of one qualifying statement.

2.2 Qualifiers

Several trace level results were reported in samples (and blanks) by the laboratory at concentrations substantially below those demonstrated by available instrumentation. Examination of the absorbance values provided for the calibration standards revealed that concentrations which correspond to absorbance values substantially below 0.003 were in some cases reported as positive results. Absorbance measurements below this (0.003) cannot be discerned from "instrument noise." Concentrations which have been reported in samples deemed to be below these instrument detection limits have been removed from the sample data tables. Furthermore, concentrations reported in blanks below these instrument detection limits were not used to question results clearly above demonstrated instrument sensitivity.

Listed below are the best achievable detection limits which correspond to 0.003 absorbance:

Constituent	Best Achievable Detection Limit
aluminum	100 ug/l
antimony	10 ug/l
arsenic	11 ug/l
barium	100 ug/l
beryllium	10 ug/l
cadmium	3 ug/l
chromium	10 ug/l
cobalt	20 ug/l
copper	30 ug/l
iron	40 ug/l
lead	10 ug/l
manganese	10 ug/l
mercury	0.6 ug/l
nickel	40 ug/l
selenium	10 ug/l
silver	15 ug/l
thallium	15 ug/l
tin	300 ug/l
vanadium	100 ug/l
zinc	10 ug/l

3.0 SUMMARY

The attached quality assurance review has identified several aspects of the analytical data that have required qualifying statements. A detailed support documentation contains specific details on this quality assurance review.

Report prepared by:

Christine M. Jacecko — 7/7/87 Date

Report reviewed by:

Robert D. Vitale — 7/7/87 Date

RJV/gnl

FILE: 272-11

QUALITY ASSURANCE REVIEW OF LABORATORY ANALYTICAL DATA BIOACCUMULATION STUDIES

TYSON'S SITE
OFF-SITE OPERABLE UNITS
REMEDIAL INVESTIGATION

3 April 1987

Prepared For:

CIBA-GEIGY Corp.
44 Saw Mill River Road
Ardsley, New York

Prepared By:

Environmental Resources Management, Inc.
999 West Chester Pike
West Chester, Pennsylvania 19382

TYSON'S SITE

QUALITY ASSURANCE REVIEW

1.0 Sample Identification

This quality assurance report is based upon a review of the data generated for the following samples which were submitted for laboratory analyses on October 14, 1986:

Sample Description	Hazelton Sample Number
Turtle Muscle C	61003079
Turtle Fat C	61003080
Turtle Muscle S	61003083
Turtle Fat S	61003084
Clam C	61003085
Clam B.P.	61003086
Impatiens SWMP	61003088
Impatiens A.S.	61003088
Impatiens C	61003089

This review was performed in accordance with the National Functional Guidelines For Evaluating Organic Analyses (USEPA).

2.0 Organic Data

2.1. Introduction

The organic analyses of 9 biological samples were performed by Hazelton Laboratories of Madison, Wisconsin. These samples were analyzed using EPA method 624 for volatile hazardous substance list compounds (HSLs) plus up to 15 library searches for extraneous chromatographic peaks, EPA method 625 for acid/base/neutral (BNA) HSLs plus up to 25 library searches for extraneous chromatographic peaks and EPA method 608 for pesticides and PCBs. This report is based upon a detailed review of all available data provided in the Contract Laboratory Program (CLP) format. The following areas were examined: holding times, surrogate and matrix spike recoveries, evaluation of GC results, target compound matching quality, calibrations, and quantitation of positive results.

In general, the analytical methods utilized were those normally performed on environmental samples (i.e. soils and waters). Because of the difficulty in performing these analyses on biological media, detection limits varied considerably for semi-volatiles (0.67 mg/kg to 25 mg/kg). In addition, although

matrix inferences did not appear to be a problem for semi-volatiles and pesticides/PCBs, matrix inferences did appear to be a problem for volatile compounds. Ineffective/selective purging of volatile compounds appears to have resulted from interference problems encountered during purging of biological media.

2.2 Qualifiers

It is recommended that the reported analytical results only be used with the following qualifier statements:

- Due to the low level presence of methylene chloride, 2-butanone, and toluene in laboratory blanks, the presence of these compounds in the following samples is qualitatively questionable. This has been indicated with a "B" next to these reported results on the attached sample data summary.

Compound	Samples With Qualitatively Questionable Results
methylene chloride	All positive sample results
2-butanone	All positive sample results
toluene	All positive sample results except sample Fat-S.

- All reported results for acetone have been flagged as not valid "NV" since all sampling equipment was decontaminated with acetone during sampling.

- The reported result for beta-BHC in the swamp Impatiens sample is not reliable and has been flagged "NR" on the sample data summary. This is because the method of analysis depends on a single peak responce on dual GC columns. This method can easily generate artifactual positive results particularly for early eluting compounds like beta-BHC due to random chromatographic interferences. In addition, it should be noted that both laboratory blanks had a peak on both the primary and confirmation column within the retention window of beta-BHC.

- Although bis (2-ethylhexyl) phthalate was not detected in either laboratory blanks, this compound is a very common laboratory contaminant. This, combined with the fact that all positive results for this phthalate ester were reported at concentrations less than the method quantitation limit indicates the reported results should be considered suspected unreliable. This has been indicated with an "H" on the sample data summary.

- All positive results and/or detection limits for the volatile organic compounds (VOCs) in all samples should be considered estimated since the biological samples were not analyzed for VOCs until 45 days after sample receipt by the laboratory. Although there are no Federal Register regulations governing the holding times for VOC analysis for biological media, substantial losses or substantial contamination by VOCs during a 45 day holding period cannot be ruled out particularly since a storage blank was not used. Secondly, the analytical method EPA 624 for the analysis of VOCs is primarily used for environmental media (i.e. soils). The fact that erratic VOA surrogate spike recoveries, matrix spike recoveries and erratic internal standard areas were obtained seems to indicate a problem with purging efficiency from the sample media. Accordingly all positive VOC data has been flagged with a "J".

- All positive results for benzyl alcohol and benzoic acid should be considered estimated since examination of the calibration standard used to quantitate these results had response factors with high percent differences compared to their initial 5-point calibration curve.

- The reported results for PCB 1260 in the Fat-C and Fat-S samples are qualitatively valid and the quantitation has been reproduced within acceptable variation.

2.3 Summary

This quality assurance review has identified several areas of concern. Supporting quality assurance review support documentation is provided in the attached appendix.

Report prepared by Rock J. Vitale
QA/QC Manager

Date 4/9/87

FILE: 272-11

TYSON'S SITE
QUALITY ASSURANCE REVIEW

7 July 1987

Prepared By:

Environmental Resources Management, Inc.
999 West Chester Pike
West Chester, PA 19382

TYSON'S SITE

QUALITY ASSURANCE REVIEW

The following quality assurance report is based upon a review of the data generated for the analysis of part per trillion levels of 1,2,3-trichloropropane (TCP) in aqueous samples obtained from the Schuylkill River.

1.0 Introduction

The analyses of 2 aqueous samples was performed by Lancaster Laboratories, of Lancaster, Pennsylvania using an expanded version EPA Method 625. The analyses of 11 aqueous samples was performed by CompuChem Laboratories of Research Triangle Park, North Carolina using EPA Method 524.2. The analytical results are presented on the attached data table.

2.0 Analytical Methodologies

Lancaster Laboratories

The samples analyzed by Lancaster Laboratories was performed utilizing a methylene chloride extraction and reduction of 10 liters of sample to a final extract volume of 70 ul. Full scan GC/MS analysis with 2 ul extract injections enabled the laboratory to report a 7 ppt detection limit.

The extraction efficiency was monitored by the addition of D_5-nitrobenzene and quantitation was performed by the use of 2-fluorobiphenyl as an internal standard.

All calibrations, tuning, operating conditions are identical to those specified in EPA Method 625.

CompuChem Laboratories

The samples analyzed by CompuChem Laboratories were performed by EPA Method 524.2. This method utilizes a purge and trap capillary column interfaced with a mass spectrometer.

A 10 ppt detection limit was required for the trichloropropane analysis for all samples. That detection limit was achieved by operating the mass spectrometer in the selective ion monitoring (SIM) mode rather than in the full scan mode.

Three ions were monitored for the 1,2,3-trichloropropane:

m/z 75 from the C3H4Cl fragment
m/z 110 from the C3H4Cl2 fragment
m/z 112 from the C3H4Cl fragment

The intensity of the m/z 110 ion is approximately 30 percent of the intensity of the base ion (m/z 75) and was chosen for the quantitation mass due to the relative lack of interference observed as compared to the interference in the m/z 75 ion. Confirmation of the presence of 1,2,3-trichloropropane was based on the following criteria:

1. All three characteristic ions must be present.

2. The ratio of the mass 112 area to the mass 110 area must be within the range 0.50 - 0.80.

3. The relative retention time of the sample peak must be within 2% of the relative retention of the standard peak.

Each sample was analyzed by purging a 5 ml aliquot and trapping the purged analyte on a sorbent trap. The trap specified in the EPA CLP methods was utilized which contains silica gel, tenax, and OV101. The purge unit was an OI liquid sampler. In order to enhance the purging efficiency of the very low levels of analyte expected in these samples the purge vessel was placed in a sand bath that was maintained at 90° C. Purge flows were set at 80 ml per minute and the sample was purged for 2 minutes. At the end of the purge cycle the sample was immediately desorbed onto a 30 meter J&W DB-5 fused silica capillary column. The GC conditions were:

Initial temperature	0° C
Initial time	0 minutes
Ramp rate	19°/minute
Final temperature	225° C

Although the compounds of interest elutes well before the final temperature the GC was allowed to attain the final temperature in order to reduce the likelihood of any sample carryover.

3.0 Qualification of Sample Results

The results for the analysis of TCP are quantitatively and qualitatively acceptable as reported with the exception of one sample result (April 87 - Station H) whose positive result (18 ppt) has been designated qualitatively questionable "B" on

the sample data table. A trace level of TCP was found in a laboratory method blank at a sufficient concentration to question the aforementioned sample result.

The areas that have been examined in detail include all available sample data, holding times, blank results, surrogate and matrix spike recoveries, duplicate precision, target compound matching quality (theoretical isotope ratios), retention time criteria, instrument tuning and calibration/quantitation. A detailed support documentation contains specific details on this quality assurance review.

Report prepared by:

Rock J. Vitale
QA/QC Manager

7/10/87
Date

TYSON'S SITE
SCHUYLKILL RIVER RESULTS

(Concentration in ppt)

COMPOUND: 1,2,3-TRICHLOROPROPANE

Apr-87		Jun-87	
Station N (Norristown Intake)	350	River Pt #1 Far Upstream	BDL
		River Pt #2 Station H	BDL
Station H (Upstream)	18 B	River Pt #3 Norris Raw	210
		River Pt #4 Norris Treated	430
		Queen's Lane Raw	170
		Queen's Lane Treated	190
		Spring Mill	310
		Belmon Raw	160
		Belmont Treated	130
		Bartrum Park	100
		Linden Ave. (Delaware River)	BDL

Note : BDL = Below detective limit.

Qualifier Code:
B - This result is of questionable qualitative significance since a trace level of TCP was also present in a blank.

APPROVED FOR RELEASE BY QUALITY ASSURANCE
7/9/87
QA/QC MANAGER DATE

AR301301

Quant Verification

River Pt#3

$$\frac{\text{area 110 spl}}{\text{area 110 Std}} \times \frac{\text{conc std}}{\text{RF}} = \frac{626496}{1738860} \times \frac{100\text{ppt}}{0.175} = 205.9 \text{ ppt}$$

reported 210 ppt

River Pt#4

$$= \frac{1311800}{1745840} \times \frac{100 \text{ ppt}}{0.175} = 429.4 \text{ ppt}$$

reported 430 ppt

River Pt#4 Dup.

$$= \frac{1258060}{1775190} \times \frac{100 \text{ ppt}}{0.175} = 404.9 \text{ ppt}$$

reported 410 ppt

River Pt#4 Trip

$$= \frac{1384150}{1980080} \times \frac{100 \text{ ppt}}{0.175} = 399.5 \text{ ppt}$$

reported 400 ppt

Prep blk

$$= \frac{53043}{1817470} \times \frac{100 \text{ ppt}}{0.175} = 16.6 \text{ ppt}$$

Spike (50 ppt)

$$= \frac{101948}{2262410} \times \frac{100 \text{ ppt}}{0.095} = 47.3 \text{ ppt}$$

reported 47 = 95%

Spike (20 ppt)

$$= \frac{58024}{2254590} \times \frac{100 \text{ ppt}}{0.095} = 27.1 \text{ ppt}$$

reported 27 = 135%

Bartrum Park

$$= \frac{737984}{4289470} \times \frac{100 \text{ ppt}}{0.166} = 103.6 \text{ ppt}$$

reported 100 ppt

112/110 Chlorine Isotope Ratio

Criteria must be within the theoretical range of 0.50-0.80

50ppt STD	0.64	
Blk	ND	
Trip Blk	0.50	
River Pt#1	ND	
River Pt#2	ND	
River Pt#3	0.73	
River Pt#4	0.77	
River Pt#4-Dup.	0.67	
River Pt#4-Trip	0.66	
Prep Blk	0.50	
50ppt spike	0.42	- out of theoretical range
20ppt spike	0.29	- out of theoretical range
50ppt standard	0.64	
50ppt standard	0.59	
Blank	ND	
Blank	ND	
Bartrum Park	0.63	
Queen's Lane Treated	0.65	
Spring Mill	0.65	
Belmont Treated	0.67	
Belmont Treated Dup.	0.64	
Belmont Treated Trip	0.64	
Belmont Raw	0.65	
Linden Ave.	ND	
50ppt spike	0.65	

Quant Verification - Continued

Queen's Lane Treated = $\frac{1202360}{3874350} \times \frac{100 \text{ ppt}}{0.166}$ = 186 ppt

reported 190 ppt

Spring Mill = $\frac{1584890}{3054270} \times \frac{100 \text{ ppt}}{0.166}$ = 312.6 ppt

reported 310 ppt

Belmont Treated = $\frac{924240}{4344470} \times \frac{100 \text{ ppt}}{0.166}$ = 128.2 ppt

reported 130 ppt

Belmont Treated Dup. = $\frac{1080890}{4207230} \times \frac{100 \text{ ppt}}{0.166}$ = 154.8 ppt

reported 160 ppt

Belmont Treated Trip = $\frac{1193370}{4377590} \times \frac{100 \text{ ppt}}{0.166}$ = 164.2 ppt

reported 160 ppt

Belmont Raw = $\frac{1128250}{4169950} \times \frac{100 \text{ ppt}}{0.166}$ = 163 ppt

reported 160 ppt

Spike (50 ppt) = $\frac{412908}{4936180} \times \frac{100 \text{ ppt}}{0.166}$ = 50.4 ppt

reported 50 ppt
= 100%

The ERM Group

TYSONS'S SITE
QUALITY ASSURANCE REVIEW

9 July 1987

Prepared For:

Prepared By:

Environmental Resources Management, Inc.
999 West Chester Pike
West Chester, Pennsylvania 19382

File No.: 272-11

TYSONS' SITE

QUALITY ASSURANCE REVIEW

The following quality assurance report is based upon a review of the data generated from the samples presented on Table 1. A summary of the methods and the method references are presented on Table 2 and 3, respectively.

This review was performed in accordance with the Functional Guidelines for Evaluating Organic and Inorganic Analyses (USEPA).

1.0 ORGANIC DATA

1.1 Introduction

The organic analyses of 5 aqueous samples, 6 river sediment samples, and 6 subsoil samples were performed by Lancaster Laboratories of Lancaster, Pennsylvania. The aqueous samples were analyzed using EPA methodologies for volatile target compound list (TCL) compounds and one additional compound (1,2,3 trichloropropane), acid/base/neutral extractable TCL compounds, up to 30 library searches for extraneous chromatographic peaks, and TCL pesticides/PCBs. The river sediment and subsoil samples were analyzed using EPA methodologies for total organic carbon (TOC). The findings offered in this report are based upon a detailed review of all available documentation of sample data, holding times, blank results, surrogate and matrix spike recoveries, evaluation of GC results, target compound matching quality, instrument tuning, calibrations/quantitation, the reported detection limits, and tentatively identified compounds.

In general, the organic analyses of the aforementioned aqueous and river sediment samples were performed acceptably with the exception of a few problems requiring several qualifying statements.

1.2 Qualifiers

- Due to the low level presence of methylene chloride and 1,2,3 trichloropropane in a method blank, the presence of these compounds in the following samples is qualitatively questionable. This has been indicated with a "B" next to these reported results on the attached sample data tables.

TABLE 1

ERM Sample #	Lancaster Sample #
Aqueous Samples	
FP-001	1149883
FP-002	1149884
FP-003	1149885
FP-004	1149886
FP-011	1149889
FP-A	1149908
FP-B	1149909
FP-C	1149910
FP-D	1149911
FP-E	1149912
River Sediment Samples	
Station C	1155056
Station E	1155057
Station F	1155051
Station G	1155052
Station H	1155058
Station J	1155053
Subsurface Soils (Eastern Lagoon)	
SB-1 5'	1142174
SB-1 10'	1142177
SB-1 15'	1142178
SB-1 20'	1142179
SB-3 10'	1142180
SB-3 20'	1142181

METHODOLOGY SUMMARY

Analysis for HSL Volatiles by GC/MS in Water and Wastewater

The sample is purged with Helium and the volatiles are collected on a Tenax/Silica gel trap. The trap is desorbed onto the GC column where components of the sample are separated and then on to the mass spectrometer for spectral evaluation.

Analysis for HSL Semi-Volatiles

The sample is solvent extracted and the extract is analyzed by GC/MS.

Analysis for HSL Pesticides in Water and Wastewater

Pesticides are extracted with methylene chloride. The extract is dried and concentrated, then analyzed quantitatively by gas chromatography. If necessary, florisil is used to eliminate interferences.

Analysis for Moisture

A well-mixed sample is placed in a weighed beaker and dried to constant weight in an oven at 103 to 105 C. The decrease in weight of the sample is the moisture.

Analysis for Total Organic Carbon

Following acidification, the sample is purged with nitrogen to remove inorganic carbon. Persulfate is injected to oxidize organic carbon to CO_2 which is detected by IR. OI Model 700 TOC Analyzer is used.

Analysis for Aluminum, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Nickel, Silver, Tin, Vanadium, Zinc, and Thallium in Water and Wastewater

The sample is prepared by heating with nitric and hydrochloric acids. The analysis is performed by Flame Atomic Absorption.

Analysis for Antimony, Arsenic, and Selenium in Water and Wastewater

The sample is acid digested and analyzed by Hydride Generation Atomic Absorption.

Analysis for Mercury in Water and Wastewater

The sample is prepared by heating at 95 C with nitric acid, sulfuric acid, potassium permanganate, and potassium persulfate. The analysis is performed by Cold Vapor Atomic Absorption.

TABLE 3

METHOD REFERENCES

Analysis	References
HSL Volatiles	USAEPA Contract Lab Program May, 1984, Revised July, 1985. IFB WA85-J176, J177, J178.
HSL Semi-Volatiles	USAEPA Contract Lab Program May, 1984, Revised July, 1985. IFB WA85-J176, J177, J178.
HSL Pesticides	USAEPA Contract Lab Program May, 1984, Revised July, 1985. IFB WA85-J176, J177, J178.
Moisture	EPA 600/4-79-020, Method 160.3
Total Organic Carbon	EPA 600/4-79-020, Method 415.2
Aluminum	EPA 600/4-79-020, Method 202.1
Antimony	EPA 600/4-79-020, Method 206.3 Adapted
Arsenic	EPA 600/4-79-020, Method 206.3
Barium	EPA 600/4-79-020, Method 208.1
Beryllium	EPA 600/4-79-020, Method 210.1
Cadmium	EPA 600/4-79-020, Method 213.1
Chromium	EPA 600/4-79-020, Method 218.1
Cobalt	EPA 600/4-79-020, Method 219.1
Copper	EPA 600/4-79-020, Method 220.1
Iron	EPA 600/4-79-020, Method 236.1
Lead	EPA 600/4-79-020, Method 239.1
Manganese	EPA 600/4-79-020, Method 243.1
Mercury	EPA 600/4-79-020, Method 245.1
Nickel	EPA 600/4-79-020, Method 249.1
Selenium	EPA 600/4-79-020, Method 270.3
Silver	EPA 600/4-79-020, Method 272.1
Tin	EPA 600/4-79-020, Method 282.1
Vanadium	EPA 600/4-79-020, Method 286.1
Zinc	EPA 600/4-79-020, Method 289.1
Thallium	EPA 600/4-79-020, Method 279.1

Compound	Samples with Questionable Results
1,2,3 trichloropropane	FP-002
methylene chloride	FP-004

- The actual detection limit for 2-butanone in all of the aqueous samples may be substantially higher than reported. This is because examination of the associated initial 5 point calibration standard and the associated 50 ppb continuing calibration standards revealed response factors of less than 0.05 for this compound. Response factors such as these indicate a lack of sensitivity for 2-butanone.

- The actual detection limit for benzidine in all of the aqueous samples may be higher than reported. This is because examination of the initial 5 point calibration standards revealed response factors for benzidine of less than 0.05.

- It should be noted that the analyses of total organic carbon (TOC) does not provide an indication of the presence of volatile organic compounds. With the analytical method that is used to analyze TOC, the sample is purged with nitrogen to liberate all inorganic species of carbon. (i.e., bicarbonates). During this purging, light volatile organic compounds are also liberated. Therefore, the parameter "total" organic carbon cannot be considered an absolute.

2.0 INORGANIC DATA

2.1 Introduction

The inorganic analyses of 9 aqueous samples were performed by Lancaster Laboratories. These samples were analyzed using EPA approved methodologies for Task I and II inorganic constituents. The findings offered in this report are based upon a detailed review of all available documentation of sample data, holding times, blank results, matrix spike recoveries, duplicate analyses quantitation of positive results, calibrations, and detection limits.

In general, the inorganic analyses performed acceptably with the exception of a few problems requiring several qualifying statements.

2.2 Qualifiers

- Due to the presence of aluminum and zinc in a method blank, the presence of these constituents in the following samples is qualitatively questionable. This has been indicated with a "B" next to the reported results on the attached sample data tables.

Constituent	Samples with Questionable Results
aluminum	all positive sample results
zinc	all positive sample results

- Many trace level results were reported in samples (and blanks) by the laboratory at concentrations substantially below those demonstrated by available instrumentation. Examination of the absorbance values provided for the calibration standards revealed that concentrations which correspond to absorbance values substantially below 0.003 were in some cases reported as positive results. Absorbance measurements below this (0.003) cannot be discerned for "instrument noise." Concentrations which have been reported in samples deemed to be below these instrument detection limits have been removed for the sample data table. Furthermore, concentrations reported in blanks below these instrument detection limits were not used to question results clearly above demonstrated instrument sensitivity.

Listed below are the best achievable detection limits which correspond to 0.003 absorbance:

Constituent	Best Achievable Detection Limit
aluminum	100 ug/l
antimony	10 ug/l
arsenic	11 ug/l
barium	100 ug/l
beryllium	10 ug/l
cadmium	3 ug/l
chromium	10 ug/l
cobalt	20 ug/l
copper	30 ug/l
iron	40 ug/l
lead	10 ug/l
manganese	10 ug/l
mercury	0.6 ug/l
nickel	40 ug/l

selenium	10 ug/l
silver	10 ug/l
thallium	15 ug/l
tin	300 ug/l
vanadium	100 ug/l
zinc	10 ug/l

3.0 SUMMARY

The attached quality assurance review has identified several aspects of the analytical data that have required qualifying statements. A detailed support documentation contains specific details on this quality assurance review.

Report Prepared by:

Christine M. Jacecko — Date 7/17/87

Report Approved by:

Rock J. Vitale — Date 7/17/87

APPROVED FOR RELEASE
QUALITY ASSURANCE
QA/QC MANAGER 7/7/86 DATE

TYSON'S SITE
FLOODPLAIN AREA SURFACE WATER RESULTS
MARCH, 1987
HSL ORGANIC COMPOUNDS
(Concentration in mg/L)

	FP-001	FP-002	FP-003	FP-004	FP-011
Volatile					
1,2,3-trichloropropane	0.129	0.002 B	0.998	0.013	
trichloroethene	0.009				
methylene Chloride				0.006 B	
Semi-volatile	ND	ND	ND	ND	ND
PCB's and Pesticides	ND	ND	ND	ND	ND
Tentatively Identified Compounds					
Volatile					
unknown				0.074 J	
Semi-volatiles					
oxirane, (chloromethyl)-			0.009 J		
unknown			0.008 J		
1-propanol, 2,3-dichloro-			0.086 J		
urea, tetramethyl-			0.009 J		
unknown	0.035 J		0.007 J	0.005 J	
unknown	0.046 J		0.095 J	0.005 J	
unknown	0.130 J		0.011 J	0.006 J	
unknown	0.011 J		0.006 J		
2h-pyrano(2,3-c)-pyridine, 6-methyl-			0.007 J		
unknown			0.015 J		
unknown			0.09 J		
unknown			0.13 J		
unknown			0.13 J		
unknown			0.007 J		

Qualifier Codes:
B: This result is of questionable qualitative significance since this compound was detected in blanks at similar concentrations.
ND: None Detected
Blank = none detected
J: This result should be considered a quantitative estimate.

TYSON'S SITE
SCHUYLKILL RIVER SEDIMENT SAMPLES
APRIL, 1987

	Station C	Station E	Station F	Station G	Station H	Station J
Moisture % by wt.	41.6	59.8	21.3	53.2	58.5	27.4
TOC mg/kg as received	6900	8800	1800	11000	3800	2400
TOC mg/kg dry wt. basis	12000	22000	2300	24000	9200	3300

APPROVED FOR
RELEASE BY
QUALITY ASSURANCE
Ross J. Ustua 7/17/87
QA/QC MANAGER DATE

TYSON'S SITE
SOIL SAMPLE RESULTS

Sample # Date	SB-1 5' 2/25/87	SB-1 10' 2/25/87	SB-1 15' 2/26/87	SB-1 20' 2/26/87	SB-3 10' 3/2/87	SB-3 20' 3/2/87
TOC mg/kg (dry weight basis)	2300	3800	2900	2200	13000	1300

APPROVED FOR
RELEASE BY
QUALITY ASSURANCE
3/17/87
QA/QC MANAGER DATE

APPROVED FOR RELEASE BY QUALITY ASSURANCE
7/17/87
QA/QC MANAGER DATE

TYSON'S SITE
FLOODPLAIN AREA SURFACE WATER SAMPLES
INORGANIC CONSTITUENTS
March, 1987
(concentrations in mg/L, ppm)

CONSTITUENT	FP-001	FP-002	FP-003	FP-004	FP-011 Blind Blank	FP-A FP-004 filtered	FP-B FP-003 filtered	FP-C FP-002 filtered	FP-D FP-001 filtered	FP-E Duplicate FP-A
ALUMINUM		0.2 B	0.2 B	0.1 B						
BARIUM	0.1	0.2	0.1			0.1	0.1	0.1	0.1	0.1
COPPER					0.04					
IRON	0.08	0.22	1.60	0.21			0.64		0.04	
MANGANESE	0.03	0.01	0.19	0.01			0.20		0.03	
ZINC			0.02 B	0.03 B		0.02 B	0.02 B		0.04 B	0.03 B

Qualifier Codes:
B: This result is of questionable qualitative significance since this constituent was detected in blanks at similar concentrations.
Blank = none detected

AR301316

File: 272-11

Tyson's Site

Quality Assurance Review

30 May 1987

Prepared By:

Environmental Resources Management, Inc.
999 West Chester Pike
West Chester, Pennsylvania 19382

Tyson's Site

Quality Assurance Review

The following quality assurance report is based upon a review of the data generated for the following samples from the seep area, hillside area, railroad area, the wetlands/floodplain area, and select aqueous samples. The samples included in this review are presented on Table 1. A summary of the methods and the method references are presented on Tables 2 and 3, respectively.

This review was performed in accordance with the Functional Guidelines for Evaluating Organic and Inorganic Analyses (USEPA).

1.0 ORGANIC DATA

1.1 Introduction

The organic analysis of 64 soil samples and 12 aqueous samples were performed by Lancaster Laboratories of Lancaster, Pennsylvania. These samples were analyzed using EPA methodologies and the majority were analyzed for volatile priority pollutant/hazardous substance list compounds and 1 additional volatile compound (1,2,3-trichloropropane) plus up to 15 library searches for extraneous chromatographic peaks, acid/base/neutral extractable priority pollutant/hazardous substance list compounds plus up to 25 library searches for extraneous chromatographic peaks and pesticides/PCBs. The findings offered in this report are based upon a detailed review of all available documentation of sample data, holding times, blank results, surrogate and matrix spike recoveries, evaluation of GC results, target compound matching quality, instrument tuning, calibrations/quantitation, and tentatively identified compounds.

In general, the organic analyses of the aforementioned soil samples were performed acceptably with exception of a few problems requiring several qualifying statements.

1.2 Qualifiers

- Due to the low level presence of acetone, 2-butanone, carbon disulfide, methylene chloride, 2-hexanone, 4-methyl-2-pentanone, chloroform, toluene, di-n-butyl phthalate, bis (2-ethylhexyl) phthalate, diethyl phthalate and di-n-octyl phthalate in field and/or laboratory blanks, the presence of

TABLE 1

	ERM Sample #	Lancaster Sample #
	SS001	1081242
	SS002	1081243
	SS003	1081244
	SS004	1081245
	SS005	1081246
	SS006	1081247
	SS007	1081251
	SS008	1081252
	SS009	1081253
	SS010	1081254
	SS012	1081256
	SS014	1081258
	SS015	1081259
	SS016	1081260
HS	SS018	1082293
HS	SS019	1082294
HS	SS021	1082296
HS	SS023	1082298
HS	SS024	1082299
HS	SS025	1082300
	SS026	1084401
	SS027	1084402
	SS028	1084403
	SS029	1084404
	SS030	1084405
	SS031	1084406
	SS032	1084407
	SS033	1084408
	SS035	1084409
	SS036	1084410
	SS037	1084411
	SS039	1084413
	SS042	1084415
	SS057	1085740
	SS061	1085746
	SS044	1084697
	SS045	1084698
	SS047	1084699
	SS048	1084701
	SS062	1085747
	SS063	1085749
	SS051	1084703
	SS053	1084702
	SS054	1084706
	SS055	1084707
	SS064	1086184

TABLE 1
(continued)

ERM Sample #	Lancaster Sample #
SS065	1086187
SS069	1103919
SS068	1087879
SS070	1103920
SS071	1108119/1108057
SS072	1108120/1108058
SS073	1108121/1105059
SS074	1108122/1108060
SS075	1108125/1108063
SS076	1108126/1108064
SS077	1108127/1108065
SS078	1108128/1108066
SS079	1108132/1108070
SS080	1108133/1108071
SS081	1108130/1108068
SS082	1108131/1108069
SS083	1108134/1108072
SS085	1108129/1108067

Aqueous Samples

ERM Sample #	Lancaster Sample #
GW035	1097416
GW037	1097410
GW036	1097409
SW001	1108147/1108155
SW002	1108148
SW003	1108149
SW004	1108150
SW005	1108151
SW006	1108152
SW007	1108153
SW008	1108155
SW009	1108156

TABLE 2

METHODOLOGY SUMMARY

Analysis for Moisture

A well-defined sample is placed in a weighed beaker and dried to constant weight in an oven at 103 to 105°C. The decrease in weight of the sample is the Moisture.

Analysis for Aluminum, Antimony, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Nickel, Silver, Tin, Vanadium, Zinc, and Thallium in Soils

The sample is prepared according to SW 846 Method 3050. The organic material is oxidized and the metals dissolved with Nitric Acid, Hydrogen Peroxide, and Hydrochloric Acid. The sample is analyzed by Flame Atomic Absorption.

Analysis for Arsenic and Selenium in Soils

The sample is prepared by digestion with Nitric and Sulfuric acids. The analysis is performed by Hydride Generation Atomic Absorption.

Analysis for Mercury in Soils

The sample is digested with Aquaregia and Potassium Permanganate at 95°C. The analysis is performed by cold Vapor Atomic Absorption.

Analysis for pH

The activity of hydrogen ions in the sample is measured using a glass electrode and a reference electrode.

Analysis for HSL Volatiles by GC/MS

The sample is purged with helium and the volatiles are collected on a Tenax/Silica gel trap. The trap is desorbed onto the GC column where components of the sample are separated and then on to the mass spectrometer for spectral evaluation.

Analysis for HSL Semi-Volatiles

The sample is solvent extracted and the extract is analyzed by GC/MS.

TABLE 2

METHODOLOGY SUMMARY
(continued)

Analysis for Pesticides and PCBs

Pesticides are extracted by sonic probe. The extract is washed with water, dried, concentrated, and florisiled to minimize interferences.

TABLE 3

METHOD REFERENCES

Analyte	Reference
Moisture	EPA 600/4-79-020, 160.3
Aluminum	EPA SW 846 2nd ed. 1984, Method 3050
Antimony	EPA SW 846 2nd ed. 1984, Method 7040
Arsenic	EPA SW 846 2nd ed. 1984, Method 7061
Barium	EPA SW 846 2nd ed. 1984, Method 7080
Beryllium	EPA SW 846 2nd ed. 1984, Method 7090
Cadmium	EPA SW 846 2nd ed. 1984, Method 7130
Chromium	EPA SW 846 2nd ed. 1984, Method 7190
Cobalt	EPA SW 846 2nd ed. 1984, Method 3050
Copper	EPA SW 846 2nd ed. 1984, Method 7210
Iron	EPA SW 846 2nd ed. 1984, Method 7380
Lead	EPA SW 846 2nd ed. 1984, Method 7420
Manganese	EPA SW 846 2nd ed. 1984, Method 7461
Mercury	EPA SW 846 2nd ed. 1984, Method 7471
Nickel	EPA SW 846 2nd ed. 1984, Method 7520
Selenium	EPA SW 846 2nd ed. 1984, Method 7741
Silver	EPA SW 846 2nd ed. 1984, Method 7760
Tin	EPA SW 846 2nd ed. 1984, Method 3050
Vanadium	EPA SW 846 2nd ed. 1984, Method 3050
Zinc	EPA SW 846 2nd ed. 1984, Method 7950
pH	EPA 600/4-79-020, Method 150.1
Thallium	EPA SW 846 2nd ed. 1984, Method 7840
Volatiles	IFB WA85-176, 177, 178 USAEPA Contract Lab Program
Semi-Volatiles	IFB WA85-176, 177, 178 USAEPA Contract Lab Program
Pesticides/PCBs	IFB WA85-176, 177, 178 USAEPA Contract Lab Program

these compounds in the following samples is qualitatively questionable. This has been indicated with a "B" next to these reported results on the attached sample data tables.

Compound	Samples with Questionable Results
carbon disulfide	All positive sample results
acetone	All positive sample results
methylene chloride	All positive sample results
2-butanone	All positive sample results
2-hexanone	SS026, SS039, SS051, SS001, and SS069
4-methyl-2-pentanone	SS072, SS026, SS039, SS001
chloroform	SS066, SS038, SS018,
toluene	SS068, SS069, SS026, SS035, SS037, SS035, SS037, SS039, SS018, SS025, SS057, SS044, SS053, and SW005
di-n-butyl phthalate	All positive sample results
diethyl phthalate	SS072
di-n-octylphthalate	SS072

- The reported result for total xylenes in sample SS073 is a suspect result and has accordingly been flagged "S" on the sample data tables. The VOA analysis of sample SS073 was performed immediately following SS072 which contained an elevated concentration of total xylenes (200 ug/kg). As a result, there is a strong possibility that the 7 ug/kg reported in SS073 is the result of chromatographic carry over ("ghosting").

- The reported result for 1,1,2,2-tetrachloroethane in sample GW035 is incorrect and has been removed from the data tables. The mass spectrum submitted for this identification is actually that of 1,2,3-trichloropropane.

- The analysis laboratory neglected to report the confident identification of cis-1,3-dichloropropene is sample SS039 at a concentration of 19 ug/kg. This result has been added to the appropriate sample data table.

- Due to a laboratory transcription error, aldrin was reported in sample SS042, the laboratory apparently meant to report gamma-BHC (lindane). However, this (corrected) result, the reported result for endosulfan II in sample GW036, and the reported result for endosulfan sulfate in sample SS025 are still qualitatively questionable since the method of analysis is based upon a single peak response on dual GC columns. This method can easily generate artifactual results due to random chromatographic interferences particularly for these early eluting compounds. In addition, for all of these results the single peak response on the confirmation column fell outside a 3-sigma retention time window. Furthermore, the peaks that all three of these

identifications were based upon were also present in method and/or trip blank chromatograms. Accordingly, these results have been flagged "NC" (not confident) on the sample data tables.

- 4,4'-DDT in sample SS011, 4,4'-DDD and 4,4'-DDE in sample SS069 have been confirmed by GC/MS. In addition, several other low level results for these pesticides were identified by dual column GC procedures, and cannot be construed as confident because of some of the reasons noted in the previous qualifier. However, these low level pesticide results are strongly supported by the high level results confirmed by GC/MS in other samples obtained around the site. Consequently, these low-level results for DDT, DDD and DDE are suitable for the purpose of establishing the extent of contamination. Accordingly, these results have been designated tentative "N" on the sample data tables.

- Due to a problem with the laboratory reporting software, positive results reported as a "J" value on the "as received" laboratory reporting forms were reported as "not detected" on the "dry weight corrected" laboratory reporting forms. Since the percent mositure information was present, the reviewer has dry weight corrected these results and has incorporated them into the sample data tables. The laboratory has been informed of this problem and is attempting to correct the software programing.

- The actual concentrations and/or detection limits reported for all volatile compounds may be higher than report for samples: SS042, SS044, SS045, SS047, SS048, SS051, SS053, SS054, SS055, SS057, SS069, SS070, SS075, SS076, SS077, SS078, SS079, SS080, SS081, SS082, SS083, and SS085. The maximum allowable holding time mandated by the Federal Register before sample analysis (14 days) were, exceeded by 1 to 3 for the aforementioned samples. Accordingly, qualitatively confident volatile compounds in these samples have been flagged "J" (quantitatively estimated) on the sample data tables.

- The actual detection limits for pesticide/PBCs in sample SW001 may be higher than reported. The extraction for this analyses was performed 5 days beyond the Federal Register mandated 7 days for extraction.

- The actual detection limits for 3-nitroaniline and 4-nitroanilne in samples SS068, SS069, and SS070 are unreliable and may be substantially higher than reported. This is because examination of the associated 50 ppb continuing calibration standard revealed response factors for these compounds of less than 0.05. Response factors such as these indicate a lack of sensitivity for these compounds.

- Tentatively identified compounds of confident matching quality which are not suspected artifacts/lab contaminants are presented on the sample data summary. In particular, the presence of DDT isomers, DDD isomers, and DDE isomers were confirmed by GC/MS as tentatively identified compounds in samples SS069.

2.0 INORGANIC DATA

2.1 Introduction

The inorganic analyses of 60 soil samples and 5 aqueous samples were performed by Lancaster Laboratories. These samples were analyzed using EPA approved methodologies for inorganic priority pollutant and several additional inorganic constituents. The findings offered in this report are based upon a detailed review of all available documentation of sample data, holding times, blank results, matrix spike recoveries, quantitation of positive results, calibrations and detection limits.

In general, the inorganic analyses performed acceptably with the exception of a few problems requiring several qualifying statements.

2.2 Qualifiers

- Due to the presence of arsenic, beryllium, cadmium, mercury, selenium, silver, tin, vanadium, chromium, thallium, cobalt, copper, lead, iron and zinc in field and/or laboratory blanks, the presence of these constituents in the following samples is qualitatively questionable. This has been indicated with a "B" next to the reported results on the attached sample data summaries.

Constituent	Samples with Questionable Results
arsenic	SS062, SS051, SS002, SS004, SS006 SS008, GW035, GW036 and GW037
beryllium	SS026, SS029, SS030, SS031, SS032, SS033, SS035, SS036, SS037 SS042, SS061, SS044, SS045, SS047, SS048, SS062, SS063, SS051, SS053, SS054, SS055, SS064, SS065, SS006, SS007, SS014, SS016, and SS021
cadmium	SS045, SS022, SS069, SS068, and SS070
mercury	All positive sample results
selenium	All positive sample results
silver	All positive sample results
tin	All positive sample results

Constituent	Samples with Questionable Results
vanadium	SS039
chromium	SW001 (filtered) and SW001 (not filtered)
thallium	All positive sample results
cobalt	SS045
copper	SS062
lead	SS062, SS008, and SW001 (not filtered)
iron	GW036 and GW037
zinc	GW035, GW036 and GW037

- Several trace level results for aluminum, antimony, arsenic, cadmium, copper, chromium, cobalt, thallium lead, and mercury have been designated not valid "NV" on the sample data summary. Examination of the absorbance/concentration data for the standards provided for these metals/metaloids revealed that all of the concentration which have been flagged with an "NV" are below the demonstrated instrument detection capability. The following estimated detection limits for these constituents correspond to the lowest concentration detectable for a 0.003 absorbance. Below 0.003 absorbance an analayte signal is not discernable from instrument "noise".

Constituent	Best Possible Detection Limit	
	aqueous (ug/l)	solid (mg/kg)
aluminum	300	15
antimony	400	20
cadmium	2.0	0.10
copper	25	1.3
chromium	100	5.0
cobalt	50	2.5
thallium	250	12.5
lead	100	25
mercury	0.20	0.10

It should be noted that these detection limits should be converted to dry weight on an individual sample basis.

- The reported results for copper in samples SS061, SS044, SS063, SS064 and SS065 should be considered quantitative estimates since the continuing calibration standard which measures instrument stability was not analyzed with these samples. This has been indicated with a "J" next to these results on the sample data summary.

- The detection limits and/or positive results for antimony and manganese may be higher than reported for soil samples

due to low matrix spike/recoveries for these constituents in the solid matrix.

- The inorganic data could not be fully verified to the extent that is normally possible because "raw data" consisted of copies of analysts notebook pages and not actual instrument printouts.

3.0 SUMMARY

The attached quality assurance review has identified several aspects of the analytical data that have required qualifying statements. A detailed support documentation contains specific details on this quality assurance review.

Report prepared by:

Rock J. Vitale
ERM QA/QC Manager

Date

RJV/grl

FILE: 272-11(01)

TYSON'S SITE

QUALITY ASSURANCE REVIEW

30 June 1987

Prepared By:

Environmental Resources Management, Inc.
999 West Chester Pike
West Chester, Pennsylvania 19382

TYSON'S SITE

QUALITY ASSURANCE REVIEW

The following quality assurance report is based upon a review of the data generated for the aqueous samples listed on Table 1. A summary of the methods and the method references are presented on Table 2.

This review was performed in accordance with the Functional Guidelines for Evaluating Organic Analyses (USEPA).

1.0 ORGANIC DATA

1.1 Introduction

The organic analyses of 8 aqueous samples were performed by Lancaster Laboratories of Lancaster, Pennsylvania. These samples were analyzed using EPA-CLP methodologies for volatile priority pollutant hazardous substance list compounds and 1 additional volatile compound (1,2,3-trichloropropane). The findings offered in this report are based upon a detailed review of all available documentation of samples data, holding times, blank results, surrogate and matrix spike recoveries, target compound matching quality instrument tuning, and calibration/quantitation.

In general, the organic analyses of the aforementioned aqueous samples were performed acceptably with the exception of a few problems requiring qualifying statements.

1.2 Qualifiers

- Due to the low level presence of methylene chloride, acetone, and toluene in a method blank, the presence of these compounds in the following samples are considered qualitatively questionable. This has been indicated with a "B" next to these reported results on the attached sample data tables.

Compound	Samples with Questionable Results
methylene chloride	All positive sample results
acetone	All positive sample results
toluene	PZ-3 and PZ-7

- The actual detection limits for 2-butanone in all of the samples except PZ-3 are unreliable and may be substantially higher than reported. This is because examination of the initial 5 point calibration standard and the continuing

TABLE 1

ERM Sample #	Lancaster Sample #
PZ-0	1155914
PZ-1	1155915
PZ-2	1155916
PZ-3	1155917
PZ-4	1155918
PZ-5	1155921
PZ-7	1155922
PZ-8	1155923

TABLE 2

METHODOLOGY SUMMARY

Analysis for HSL Volatile by GC/MS in water and wastewater

The sample is purged with Helium and the volatiles are collected on a Tenax/Silica gel trap. The trap is desorbed onto the GC column where components of the sample are separated and then on to the mass spectrometer for spectral evaluation.

METHOD REFERENCES

Analysis	Reference
HSL Volatiles	USAEPA Contract Lab Program May, 1984, Revised July, 1985. IFB WA85-J176, J177, J178.

50 ppb calibration standards revealed response factors for this compound of less than 0.05. Response factors such as these indicate a lack of sensitivity and instrument instability for this compound. For sample PZ-3, the positive result for 2-butanone should be considered a quantitative estimate (J) due to the considerations stated above.

2.0 SUMMARY

The attached quality assurance review has identified a few aspects of the analytical data that have required qualifying statements. A detailed support documentation contains specific details on this quality assurance review.

Report prepared by:

Christine M. Jacecko — Date: 7/5/87

Report reviewed by:

Rock J. Vitale — Date: 7/5/87

CMJ/RJV/gnl

TYSON'S SITE
SCHUYLKILL RIVER PIEZOMETER WATER SAMPLES
HSL ORGANIC COMPOUNDS
APRIL, 1987
(concentration in mg/L)

VOLATILES	PZ-0	PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-7	PZ-8
methylene chloride	0.003 B	0.003 B	0.003 B	0.003 B	0.003 B	0.003 B	0.003 B	0.003 B
acetone	0.009 B	0.030 B	0.010 B	0.040 B	0.007 B	0.020 B	0.050 B	0.020 B
carbon disulfide				0.013			0.003J	0.006
1,1-dichloroethane						0.006		0.007
trans-1,2-dichloroethene						0.002J		
2-butanone				0.007J				
benzene						0.015		0.038
toluene				0.003 B		0.019	0.002 B	0.028
chlorobenzene						0.003J		0.038
ethylbenzene						0.005		0.020
total xylenes						0.017		0.031

Qualifier Codes:

B: This result is of questionable qualitative significance since this compound was detected in blanks(s) at similar concentrations.
J: This result should be considered a quantitative estimate.

TYSONS SITE

Quality Assurance Review

The following quality assurance report is based upon a review of the data generated for the ground water samples collected during the remedial investigation. The samples included in this review are presented on Table 1. A summary of the methods and the method references are on Tables 2 and 3 respectively.

This review was performed in accordance with the Functional Guidelines of Evaluating Organic and Inorganic Analyses (USEPA).

1.0 Organic Data

1.1 Introduction

The organic analysis of 41 aqueous samples was performed by Lancaster Laboratories of Lancaster, Pennsylvania. These samples were analyzed using EPA methodologies; the majority were analyzed for volatile priority pollutant/hazardous substance list compounds, one additional volatile compound (1,2,3-trichloropropane), up to 15 library searches were conducted for extraneous chromatographic peaks, acid/base/neutral extractable priority pollutant/hazardous substance list compounds, and up to 25 library searches were conducted for extraneous chromatographic peaks. Pesticides/PCBs were also analyzed. The findings offered in this report are based upon a detailed review of all available documentation of sample data, holding times, blank results, surrogate and matrix spike recoveries, evaluation of GC results, target compounds matching quality, instrument tuning, calibrations/quantitation, and tentatively identified compounds.

In general, the organic analysis was performed acceptably with the exception of a few problems requiring several qualifying statements.

TABLE 1

ERM Sample #	Lancaster Sample #
1	1097407
2-S	1099273
2-I	1099274
3-S	1100323
3-I	1100327
3-D	1100324
4-S	1097954
4-I	1097952
4-D	1097953
5-S	1099268
5-I	1097956
5-D	1097955
6-S	1099261
6-I	1099260
6-D	1099259
7-S	1097408
7-I	1097412
7-D	1097411
8-S	1099264
8-I	1099265
8-D	1099263
9-S	1097947
9-I	1097946
9-D	1097945
10-S	1099266
10-I	1099262
10-D	1099267
10-XD	1107025
11-S	1099258
11-I	1099257
11-D	1099256
12-S	1107020
12-D	1107021
B4	1097419
NUS3	1097418
NUS4	1097422
002	1097410
004	1097420
ERT-1-shallow	1097949
ERT-1-deep	1097950
ERT-2	1097421

TABLE 2

METHODOLOGY SUMMARY

Analysis for Aluminum, Antimony, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Nickel, Silver, Tin, Vanadium, Zinc, and Thallium in water and wastewater.

The sample is prepared by heating with nitric and hydrochloric acids. The analysis is performed by Flame Atomic Absorption.

Analysis for Arsenic and Selenium in water and wastewater

The sample is acid digested and analyzed by Hydride Generation Atomic Absorption.

Analysis for Mercury in water and wastewater

The sample is prepared by heating at 95°C with Nitric Acid, Sulfuric acid, Potassium Permanganate, and Potassium Persulfate. The analysis is performed by Cold Vapor Atomic Absorption.

Analysis for HSL Volatile by GC/MS

The sample is purged with Helium and the volatiles are collected on a Tenax/Silica gel trap. The trap is desorbed onto the GC column where components of the sample are separated and then on to the mass spectrometer for spectral evaluation.

Analysis for HSL Semi-Volatiles

The sample is solvent extracted and the extract is analyzed by GC/MS.

Analysis for Pesticides and PCB's

Pesticides are extracted with methylene chloride and hexane. The extract is dried and concentrated, then analyzed quantitatively by gas chromatography. If necessary, florisil and elemental sulfur are used to eliminate interferences.

TABLE 3

METHOD REFERENCES

Analysis	Reference
Aluminum	EPA 600/4-79-020, Method 202.1
Antimony	EPA 600/4-79-020, Method 204.1
Arsenic	EPA 600/4-79-020, Method 206.3
Barium	EPA 600/4-79-020, Method 208.1
Beryllium	EPA 600/4-79-020, Method 210.1
Cadmium	EPA 600/4-79-020, Method 213.1
Chromium	EPA 600/4-79-020, Method 218.1
Cobalt	EPA 600/4-79-020, Method 219.1
Copper	EPA 600/4-79-020, Method 220.1
Iron	EPA 600/4-79-020, Method 236.1
Lead	EPA 600/4-79-020, Method 239.1
Manganese	EPA 600/4-79-020, Method 243.1
Mercury	EPA 600/4-79-020, Method 245.1
Nickel	EPA 600/4-79-020, Method 249.1
Selenium	EPA 600/4-79-020, Method 270.3
Silver	EPA 600/4-79-020, Method 272.1
Thallium	EPA 600/4-79-020, Method 279.1
Tin	EPA 600/4-79-020, Method 282.1
Vanadium	EPA 600/4-79-020, Method 286.1
Zinc	EPA 600/4-79-020, Method 289.1
Volatiles	IFB WA85-176,177,178 USAEPA Contract Lab Program
Semi-Volatiles	IFB WA85-176,177,178 USAEPA Contract Lab Program
Pesticides/PCB's	IFB WA85-176,177,178 USAEPA Contract Lab Program

1.2 Qualifiers

- Due to the low level presence of methylene chloride, acetone, chloroform, 2-butanone, toluene, xylene, di-n-butyl phthalate, bis(2-ethylhexyl) phthalate, and dimethyl phthalate, in several trip and/or method blanks, these compounds in the following samples are qualitatively questionable. This has been indicated with a "B" next to the reported results on the attached sample data tables.

Compounds	Samples with Questionable Results
methylene chloride	All positive results
2-butanone	All positive results
chloroform	4-5, 6-D, ERT-1-SH, ERT-1-DP
acetone	All positive results except 004 and B-4
xylene	4-I, 4-D, 10-XD, 7-D, and 002
toluene	4-I and 002
di-n-butyl phthalate	All positive results
bis(2-ethylhexyl) phthalate	All positive results
dimethyl phthalate	2-I

- The trace level, single peak pesticides reported in sample numbers 1, 3-S, 5-I, 5-D, 6-I, ERT-1-sh, and ERT-1-dp were flagged "NC" (not confident) due to the fact that the method of analysis is based upon a single peak response on dual GC columns. This method can easily generate artifactual results due to random chromatographic interferences. Furthermore, the peaks that some of these identifications were based upon were also present in several method blanks. In particular, these peaks were identified as lindane and endosulfan sulfate.

- The detection limits and/or positive results for BNA compounds in sample numbers 3-S, 3-I, and 3-D may be higher than reported due to the fact that the BNA extraction was performed 2 days beyond the 7 day maximum allowable holding time. Thus, positive results for the BNA compounds have been designated "J" (quantitative estimate) on sample data tables.

- The reported results for 1,2,3-trichloropropane in sample number 7-S should be considered a quantitative estimate due to the fact that the instrument concentration used for quantitation was above the highest calibration standard.

- It should be noted that samples 10-XD and 12-D have reported detection limits ten times higher than usual for BNA compounds. Due to the nature of the extract, the laboratory performed a one-to-ten dilution, which accordingly resulted in higher detection limits.

- The actual concentration of toluene may be lower than reported in sample number 3-I due to a high recovery for the matrix spike compound toluene in this sample.

- The actual detection limits reported for 2-chlorophenol, 4-nitrophenol, and N-nitrosodi-n- propylamine may be substantially higher than reported for sample 5-S. Zero percent recoveries were reported for these compounds in the matrix spike of sample 5-S.

- Although the presence of di-n-butyl phthalate has been designated questionable, if this compound is actually present in sample number 5-S, the actual concentration may be higher than reported. This is due to a zero percent recovery for the matrix spike compound di-n-butyl phthalate.

2.0 INORGANIC DATA

2.1 Introduction

The inorganic analysis of 37 aqueous samples was performed by Lancaster Laboratories. These samples were analyzed using EPA approved methodologies for inorganic priority pollutants and several additional inorganic constituents. The findings offered in this report are based upon a detailed review of all available documentation of sample data, holding times, blank results, matrix spike recoveries, quantitation of positive results, calibrations and detection limits.

In general, the inorganic analyses were performed acceptably with the exception of a few problems requiring several qualifying statements.

2.2 Qualifiers

- Due to the low level presence of aluminum, zinc and iron in several field and/or laboratory blanks the presence of these constituents in the following samples are qualitatively questionable. This has been indicated with a "B" next the appropriate results on the sample data summary.

Constituents	Samples with Questionable Results
aluminum	3-S, 8-D, 9-I, 10-XD and 12-D,
zinc	All positive sample results.
iron	2-S, 2-I, 3-I, 6-S, 7-S, 7-D and 8-S

- Many trace level results were reported in samples (and blanks) by the laboratory at concentrations substantially below those demonstrated by available instrumentation. Examination of the absorbance values provided for the calibration standards revealed that concentrations which correspond to absorbance values substantially below 0.003 were in some cases reported as positive results. Absorbance measurements below this (0.003) cannot be discerned from "instrument noise." Concentrations which have been reported in samples deemed to be below these instrument detection

limits have been removed from the sample data tables. Furthermore, concentrations reported in blanks below these instrument detection limits were not used to question results clearly above demonstrated instrument sensitivity.

Listed below are the best achievable detection limits which correspond to 0.003 absorbance:

Constituent	Best Achievable Detection Limit
aluminum	100 ug/l
antimony	10 ug/l
arsenic	11 ug/l
barium	100 ug/l
beryllium	10 ug/l
cadmium	3 ug/l
chromium	10 ug/l
cobalt	20 ug/l
copper	30 ug/l
iron	40 ug/l
lead	10 ug/l
manganese	10 ug/l
mercury	0.6 ug/l
nickel	40 ug/l
selenium	10 ug/l
silver	10 ug/l
thallium	15 ug/l
tin	300 ug/l
vanadiun	100 ug/l
zinc	10 ug/l

- The reported results for aluminum, iron, and manganese in sample 12-S should be considered estimated. These results have been flagged "J" on the sample data summary. Laboratory duplicate analysis of Sample 12-S revealed poor precision for these elements in this sample.

- The reported results for barium in sample 3-I and manganese in sample 5-I should be considered quantitive estimates and accordingly have been flagged "J" on the sample data summary. Poor laboratory duplicate precision was obtained for barium in sample 3-I, and manganese in sample 5-I respectively.

3.0 Summary

The attached quality assurance review has identified several areas requiring qualifying statements in order for the data to best be utilized. Support documentation has been prepared for this quality assurance review.

Report Prepared by:

Christine M. Jagecko — Date: 6/26/87

Report Approved by:

Rock J. Vitale — Date: 6/26/87

HSL METALS DETECTED AT TYSON'S SITE IN SEPTEMBER 1986

(All values are in mg/l)

CONSTITUENT	1	2-S	2-I	3-S	3-I	3-D	4-S	4-I	4-D	5-S
Aluminum				0.1 B		9.3				
Antimony				0.01						
Arsenic				0.011						
Barium	0.6	0.2	0.1	0.4	0.3 J	1.1	0.3	0.2	0.2	0.2
Beryllium										
Cadmium										
Chromium				0.02		0.03				
Cobalt				0.02 J						
Copper						0.03 J				
Iron		0.2 B	0.25 B	2	0.04 B	8.1				2.4
Lead										
Manganese	0.02	0.3	0.03	3.84	0.29	0.27		0.02	0.01	0.47
Mercury				0.002						
Nickel										
Selenium										
Silver										
Thallium										
Tin										
Vanadium										
Zinc	0.02 B	0.05 B	0.07 B	0.04 B	0.03 B	0.07 B	0.04 B	0.04 B		

CONSTITUENT	5-I	5-D	6-S	6-I	6-D	7-S	7-I	7-D	8-S	8-I
Aluminum		1.1								
Antimony										
Arsenic										
Barium	0.2	0.7	1.3	0.4	0.4	0.4	0.1		0.6	0.4
Beryllium										
Cadmium										
Chromium										
Cobalt										
Copper										
Iron			0.07 B			0.16 B		0.11 B	0.15 B	
Lead										
Manganese	0.01 J		1.18	0.02	0.03	0.9	0.02		0.24	0.1
Mercury										
Nickel										
Selenium										
Silver										
Thallium										
Tin										
Vanadium										
Zinc			0.02 B		0.06 B		0.01 B	0.02 B		

Qualifier Codes:
B - This result is of questionable qualitative significance since this constituent was also detected in blank(s)
J - This result should be considered a quantitative estimate

HSL INORGANIC CONSTITUENTS

(All values are in mg/l)

CONSTITUENT	8-D	9-S	9-I	9-D	18-S	18-I	18-D	18-XD	11-S	11-I
Aluminum	0.2 B		0.1 B					0.2 B		
Antimony										
Arsenic							0.016			
Barium		0.4	2.1	3		0.1	0.4	3	0.3	0.2
Beryllium										
Cadmium										
Chromium				0.03				0.01		
Cobalt										
Copper										
Iron		1.2			13.9					
Lead										
Manganese		0.05	0.02		7.38				0.08	
Mercury										
Nickel										
Selenium										
Silver										
Thallium								0.03		
Tin										
Vanadium										
Zinc		0.01 B	0.01 B	0.02 B			0.02 B			

CONSTITUENT	11-D	12-S	12-D	ERT-1 (ab)	ERT-1 (dp)	ERT-2
Aluminum		1 J	0.1 B			
Antimony						
Arsenic						
Barium	0.2	0.3		0.2	0.1	0.1
Beryllium						
Cadmium						
Chromium	0.01					
Cobalt						
Copper						
Iron		0.49 J				
Lead						
Manganese		0.01 J		0.03		
Mercury						
Nickel						
Selenium						
Silver						
Thallium						
Tin						
Vanadium						
Zinc				0.03 B	0.01 B	0.02 B

Qualifier Codes:

B - This result is of questionable qualitative significance since this constituent was also detected in blank(s)

J - This result should be considered a quantitative estimate

HSL PCB'S AND PESTICIDES

COMPOUND	1	2-S	2-I	3-S	3-I	3-D	4-S	4-I	4-D	5-S	5-I
Aldrin											
Beta BHC											
Endosulfan I	0.00001 NC										
Endosulfan II				0.0008 NC							
Endosulfan sulfate										0.00020 NC	
Gamma BHC - Lindane											
Dieldrin				0.00003 NC						0.00010 NC	

COMPOUND	5-D	6-S	6-I	6-D	7-S	7-I	7-D	8-S	8-I	8-D	9-S
Aldrin	0.00007 NC										
Beta BHC											
Endosulfan I											
Endosulfan II											
Endosulfan sulfate	0.0002 NC										
Gamma BHC - Lindane			0.0009 NC								
Dieldrin											

COMPOUND	9-I	9-D	10-S	10-I	10-D	10-XD	11-S	11-I	11-D	12-S	12-D
Aldrin											
Beta BHC											
Endosulfan I											
Endosulfan II											
Endosulfan sulfate											
Gamma BHC - Lindane											
Dieldrin											

COMPOUND	B-4	NUS-3	NUS-4	NUS-5	004	ERT-1 shallow	ERT-1 deep	ERT-2
Aldrin								
Beta BHC						0.0001 NC		
Endosulfan I								
Endosulfan II							0.00005 NC	
Endosulfan sulfate							0.0012 NC	
Gamma BHC - Lindane								
Dieldrin								

Qualifier Code:
NC: This result is not confident. The method of identification frequently generates false positive results. Further confirmatory techniques (ie; GC/MS) should be performed before this result can be considered confident.

HSL VOLATILE ORGANIC COMPOUNDS

(All values in mg/l)

COMPOUND	9-I	9-D	10-S	10-I	10-D	10-XD	11-S	11-I	11-D	12-S	12-D
1,2,3-Trichloropropane			2.7	400	100	69	980	220	20		0.017
Methylene Chloride	0.007 B	0.004 B	0.006 B				0.5 B				0.018 B
Acetone	0.02 B	0.17 B	0.04 B	1 B			1 B	17 B			0.02 B
1,1-Dichloroethane			0.019				0.7				
trans-1,2-Dichloroethene			0.13							0.082	
Chloroform				0.6			0.8				
2-Butanone		0.008 B									0.01 B
1,2-Dichloropropane											
Trichloroethene			0.051	1.9	2		1.8			1.4	
Benzene			0.022				1.7				
cis-1,3-Dichloropropene	0.014	0.011	0.014	24	0.02	0.27	8.1	18	12		
4-Methyl-2-pentanone			0.03				7				
Tetrachloroethene			0.009				0.9		0.08		
Toluene			0.08	1.1			21	3.3	0.79		
Chlorobenzene			0.048				1.5		0.09		
Ethylbenzene			0.05	0.7			3.9	1.1	0.29		
Total xylenes			0.23	4.2	1.7	0.009 B	23	7.3	1.9		

COMPOUND	8-4	NUS-3	NUS-4	002	004	ERT-1 shallow	ERT-2 deep	ERT-2
1,2,3-Trichloropropane	690	82	0.03	0.013	610	2.3	0.67	
Methylene Chloride						0.003 B		
Acetone	73				53	0.004 B	0.006 B	
1,1-Dichloroethane					0.6			
trans-1,2-Dichloroethene								
Chloroform						0.004 B	0.004 B	
2-Butanone	2 B				2 B			
1,2-Dichloropropane								
Trichloroethene	2.4	1.3			1.8	0.02	0.003 J	
Benzene	3.5			0.009	20			
cis-1,3-Dichloropropene						0.003 J	0.002 J	
4-Methyl-2-pentanone	150				110			
Tetrachloroethene	0.6	1.9			10	0.016	0.011	
Toluene	53	2.2		0.006 B	53			
Chlorobenzene	2	0.7		0.011	15			
Ethylbenzene	7.6	2.2			12			
Total xylenes	48	45		0.008 B	74			

Qualifier Codes:

B: This result is of questionable qualitative significance since this compound/constituent was detected in blanks(s) at similar concentrations.

J: This result should be considered a quantitative estimate.

HSL VOLATILE ORGANIC COMPOUNDS

(All values in mg/l)

COMPOUND	1	2-S	2-I	3-S	3-I	3-D	4-S	4-I	4-D	5-S	5-I
1,2,3-Trichloropropane		30	6.6	380	810	0.057	22	3.4	22	230	1.7
Methylene Chloride				0.8 B	0.2 B	0.02 B	0.04 B	0.004 B	0.04 B		0.003 B
Acetone	0.005 B		0.1 B	7 B	1.1 B	0.13 B	0.08 B	0.04 B	0.07 B		0.002 B
1,1-Dichloroethane					0.3				0.04 J		
trans-1,2-Dichloroethene											
Chloroform					0.5		0.04 B				
2-Butanone				0.5 B	0.3 B		0.02 B	0.006 B			
1,2-Dichloropropane							0.03 J		0.07		
Trichloroethene		0.1		1	1.3		0.07	0.003 J		1.1	
Benzene				0.9	1						
cis-1,3-Dichloropropene					4.9	1.2	0.22		0.59	1.4	0.008
4-Methyl-2-pentanone				18	7.9	0.02 J					
Tetrachloroethane		0.5		2.1				0.002 J		3.5	0.005
Toluene				32	31 J	0.051		0.008 B	0.05	2.1	
Chlorobenzene				2.4	2					0.6	
Ethylbenzene				8.8	6.4	0.031		0.006	0.04 J	6	
Total xylenes		1.6	0.09	64	40	0.25		0.011 B	0.03 B	41	

COMPOUND	5-D	6-S	6-I	6-D	7-S	7-I	7-D	8-S	8-I	8-D	9-S
1,2,3-Trichloropropane	0.09	800	1200	55	0.23 J	0.78	0.19	3.8	3.8	7.7	
Methylene Chloride	0.02 B	0.5 B					0.007 B				0.004 B
Acetone	0.04 B	3 B		0.03 B	0.01 B	0.006 B	0.02 B				0.01 B
1,1-Dichloroethane				0.009							
trans-1,2-Dichloroethene											
Chloroform				0.01 B							
2-Butanone	0.08 B	1 B									
1,2-Dichloropropane											
Trichloroethene	0.2	1.3	1.3	0.056							
Benzene		1.2	1.1	0.042							
cis-1,3-Dichloropropene	14	6.7	9.3	0.42		0.017	0.028		0.8	1.1	
4-Methyl-2-pentanone		22		0.03							
Tetrachloroethane	0.53	1.4						0.06	0.2		
Toluene	0.17	41	18	0.76					1.2		
Chlorobenzene	0.07	2.3	1.4	0.079					0.2		
Ethylbenzene	0.73	9	3.7	0.27					0.3		
Total xylenes	4.9	54	22	1.8			0.003 B		3.8		

Qualifier Codes:
B: This result is of questionable qualitative significance since this compound/constituent was detected in blanks(s) at similar concentrations.
J: This result should be considered a quantitative estimate.

HSL SEMI-VOLATILE ORGANIC COMPOUNDS
(All values are in mg/l)

COMPOUND	1	2-S	2-I	3-S	3-I	3-D	4-S	4-I	4-D	5-S	5-I
Aniline											
Phenol				1.6 J	0.1 J						
4-Methylphenol				2.5 J							
2,4-Dimethylphenol				1.2 J							
2-Methylphenol				0.3 J							
Benzoic acid				0.3 J							
1,2-Dichlorobenzene											
1,4-Dichlorobenzene				0.8 J	0.4 J					0.4	
Nitrobenzene											
N-Nitrosodiphenylamine				0.3 J	2.5 J						
1,2,4-Trichlorobenzene								0.01			
Di-n-butyl phthalate				0.6 J	0.2 J	0.06 J				0.1	
Bis(2-ethylhexyl)phthalate	0.03 B			0.2 B				0.01 B		0.1 B	
Dimethyl phthalate			0.04 B	0.08 B		0.3 B	0.02 B	0.01 B	0.006 B		0.02 B

COMPOUND	5-D	6-S	6-I	6-D	7-S	7-I	7-D	8-S	8-I	8-D	9-S
Aniline											
Phenol											
4-Methylphenol											
2,4-Dimethylphenol											
2-Methylphenol											
Benzoic acid											
1,2-Dichlorobenzene	0.005 J		1	0.01							
1,4-Dichlorobenzene											
Nitrobenzene		4	2	0.03							
N-Nitrosodiphenylamine											
1,2,4-Trichlorobenzene			5	0.08							
Di-n-butyl phthalate				0.03 B							
Bis(2-ethylhexyl)phthalate	0.005 B				0.04 B	0.02 B	0.005 B		0.3 B		0.03 B
Dimethyl phthalate											

Qualifier Codes:
B: This result is of questionable qualitative significance since this compound/constituent was detected in blank(s) at similar concentrations.
J: This result should be considered a quantitative estimate.

HSL SEMI-VOLATILE ORGANIC COMPOUNDS
(All values in mg/l)

COMPOUND	9-I	9-D	10-S	10-I	10-D	10-XD	11-S	11-I	11-D	12-S	12-D
Aniline											
Phenol	0.005 J					0.2 J					
4-Methylphenol											
2,4-Dimethylphenol											
2-Methylphenol											
Benzoic acid	0.04 J	0.01 J									
1,2-Dichlorobenzene								0.1	0.02		
1,4-Dichlorobenzene											
Nitrobenzene							3.5	0.1	0.02		
N-Nitrosodiphenylamine											
1,2,4-Trichlorobenzene							0.6	0.31	0.05		
Di-n-butyl phthalate											
Bis(2-ethylhexyl)phthalate		0.006 B									
Dimethyl phthalate											

COMPOUND	8-4	NUS-3	NUS-4	NUS-5	004	ERT-1 shallow	ERT-1 deep	2
Aniline								
Phenol								
4-Methylphenol								
2,4-Dimethylphenol								
2-Methylphenol								
Benzoic acid								
1,2-Dichlorobenzene								
1,4-Dichlorobenzene								
Nitrobenzene								
N-Nitrosodiphenylamine								
1,2,4-Trichlorobenzene								
Di-n-butyl phthalate								
Bis(2-ethylhexyl)phthalate								
Dimethyl phthalate								

Qualifier Codes:
B: This result is of questionable qualitative significance since this compound/constituent was detected in blank(s) at similar concentrations.
J: This result should be considered a quantitative estimate.

TENTATIVELY IDENTIFIED COMPOUNDS DETECTED AT THE TYSON'S SITE
(All values are ESTIMATED and in ppm)

COMPOUNDS	1	29	31	39	91	90	49
Total aliphatic hydrocarbons	0.079					0.06	
Total chlorinated hydrocarbons		12.56	0.899	26.79		2.78	
Total unknowns			91.7	21.13	3.21	0.813	1.75
Total unknown hydrocarbons							
Chlorinated propene							
Chloropropene							
Chloropropene					1200		
1-Propene							
3,3'-Oxybis-1-propene							
Phenol,4,4-(1-methylethylidene)bis			0.029				
Phenol, 2,5-Dichloro-			0.48				
n-Phenylacetamide				0.835			
Ethanone, 1-phenyl	0.0147		0.17				
Ethanone,1,1-(1,3-phenylene)bis-			0.057				
Ethanone, 1,1-(1,4-phenylene)bis-			0.017				
Ethanone, 1-(4-(1-hydroxy-1-methylethyl)phenyl-			0.023				
Octanoic acid				1.17			
3,3-Thiobis-1-propene							
1,2-Dichloro-1-propene							
1,3-Dichloro-1-propene							
2,3-Dichloro-1-propene					0.69	0.14	0.049
3,3-Dichloro-1-propene							
Chloromethybenzene							
1,3,5-Trichlorobenzene							
1,1-oxybisbenzene							
1,4-Benzodioxin							
Benzene compound							
Benzenemethanol, .alpha.-methyl					0.13		
Tetrahydrofuran							
Dimethylnaphthalene compound							
1H-Indene compound							
Pentamethyl dihydroindene compound							
Propyl furan							
3-Methylphenol				0.71			
2-Methyl-pyridine							
Hexahydro-2h-azepin-2-one							
2-Ethyl-1-hexanol							
1,7-Dihydro-6h-purin-6-one			0.16			0.56	
(Chloromethyl)-oxirane				0.32	0.24		
Fatty alcohol							

B : This analyte was also found in the method blank.
Blank = None detected.

COMPOUNDS	4I	4D	5S	5I	5D	6S
Total aliphatic hydrocarbons	0.399			0.046	0.136	
Total chlorinated hydrocarbons			30.46	0.587	0.125	316.8
Total unknowns	1.5	5.03	3.25	0.66	4.78	17.8
Total unknown hydrocarbons			2.42			
Chlorinated propene					0.55	
Chloropropene						
Chloropropene						
1-Propene						
3,3'-Oxybis-1-propene						
Phenol,4,4-(1-methylethylidene)bis						
Phenol, 2,6-Dichloro-						
n-Phenylacetamide						
Ethanone, 1-phenyl	0.027				0.046	
Ethanone,1,1-(1,3-phenylene)bis-						
Ethanone, 1,1-(1,4-phenylene)bis-						
Ethanone, 1-(4-(1-hydroxy-1-methylethyl)phenyl-						
Octanoic acid						
3,3-Thiobis-1-propene						
1,2-Dichloro-1-propene						
1,3-Dichloro-1-propene			5.7		0.044	
2,3-Dichloro-1-propene		0.056				1.27
3,3-Dichloro-1-propene						
Chloromethylbenzene						1.5
1,3,5-Trichlorobenzene						
1,1-oxybisbenzene						
1,4-Benzodioxin						
Benzene compound					0.27	
Benzenemethanol, .alpha.-methyl						
Tetrahydrofuran						
Dimethylnaphthalene compound						
1H-Indene compound						
Pentamethyl dihydroindene compound						
Propyl furan						
3-Methylphenol						
2-Methyl-pyridine						
Hexahydro-2h-azepin-2-one					0.041	
3-Ethyl-1-hexanol						
1,7-Dihydro-8h-purin-8-one						
(Chloromethyl)-oxirane						3.8
Fatty alcohol						

COMPOUNDS	61	62	78	71	79
Total aliphatic hydrocarbons			0.011	0.011	0.055
Total chlorinated hydrocarbons	308.2	8.52			
Total unknowns	1.7	3.42	0.026	0.097	0.131
Total unknown hydrocarbons					0.084
Chlorinated propene					
Chloropropene		0.03			
Chloropropene	2				
1-Propene					
3,3'-Oxybis-1-propene					
Phenol,4,4-(1-methylethylidene)bis					
Phenol, 2,6-Dichloro-					
n-Phenylacetamide					
Ethanone, 1-phenyl		0.114			0.051
Ethanone,1,1-(1,3-phenylene)bis-					
Ethanone, 1,1-(1,4-phenylene)bis-		0.954			
Ethanone, 1-(4-(1-hydroxy-1-methylethyl)phenyl-					
Octanoic acid					
3,3-Thiobis-1-propene					
1,2-Dichloro-1-propene					
1,3-Dichloro-1-propene					
2,3-Dichloro-1-propene	13	0.084			
3,3-Dichloro-1-propene					
Chloromethylbenzene	0.6				
1,3,5-Trichlorobenzene	2				
1,1-oxybisbenzene		0.065			
1,4-Benzodioxin					
Benzene compound					
Benzenemethanol, .alpha.-methyl					
Tetrahydrofuran					
Dimethylnaphthalene compound					
1H-Indene compound					
Pentamethyl dihydroindene compound					
Propyl furan					
3-Methylphenol					
2-Methyl-pyridine					
Hexahydro-2h-azepin-2-one					
2-Ethyl-1-hexanol					
1,7-Dihydro-6h-purin-6-one					
(Chloromethyl)-oxirane					
Fatty alcohol					

COMPOUNDS	SS	SI	SD	RS	RI	RD
Total aliphatic hydrocarbons					0.025	0.187
Total chlorinated hydrocarbons	1.57	28.4	4.44			
Total unknowns	0.052	0.97		0.039	0.038	0.257
Total unknown hydrocarbons						
Chlorinated propene						
Chloropropene						
Chloropropane						
1-Propene						
3,3'-Oxybis-1-propene						
Phenol,4,4-(1-methylethylidene)bis						
Phenol, 2,6-Dichloro-						
n-Phenylacetamide						
Ethanone, 1-phenyl					0.019	0.018
Ethanone,1,1-(1,3-phenylene)bis-						
Ethanone, 1,1-(1,4-phenylene)bis-						
Ethanone, 1-(4-(1-hydroxy-1-methylethyl)phenyl-						
Octanoic acid						
3,3-Thiobis-1-propene						
1,2-Dichloro-1-propene						
1,3-Dichloro-1-propene						
2,3-Dichloro-1-propene		0.17				
3,3-Dichloro-1-propene						
Chloromethylbenzene						
1,3,5-Trichlorobenzene		0.12				
1,1-oxybisbenzene						
1,4-Benzodioxin						
Benzene compound						
Benzenemethanol, .alpha.-methyl						
Tetrahydrofuran						
Dimethylnaphthalene compound						
1H-Indene compound						
Pentamethyl dihydroindene compound						
Propyl furan						
3-Methylphenol						
2-Methyl-pyridine						
Hexahydro-2h-azepin-2-one						
2-Ethyl-1-hexanol					0.012	
1,7-Dihydro-6h-purin-6-one						
(Chloromethyl)-oxirane						
Fatty alcohol						

COMPOUNDS	10S	10I	10D	10XD	11S
Total aliphatic hydrocarbons				12.02	
Total chlorinated hydrocarbons		56.7	30.29	557	276.3
Total unknowns	1.74	0.75		18.67	6.03
Total unknown hydrocarbons					
Chlorinated propene					
Chloropropene					
Chloropropene			0.6		
1-Propene					
3,3'-Oxybis-1-propene					
Phenol,4,4-(1-methylethylidene)bis					
Phenol, 3,5-Dichloro-					
n-Phenylacetamide					
Ethanone, 1-phenyl	0.015				
Ethanone,1,1-(1,3-phenylene)bis-					
Ethanone, 1,1-(1,4-phenylene)bis-					
Ethanone, 1-(4-(1-hydroxy-1-methylethyl)phenyl-					
Octanoic acid					
3,3-Thiobis-1-propene	0.023				
1,2-Dichloro-1-propene	0.72				
1,3-Dichloro-1-propene					1.1
2,3-Dichloro-1-propene	0.077	2.7	1.4		
3,3-Dichloro-1-propene		0.19			
Chloromethylbenzene					
1,3,5-Trichlorobenzene					
1,1-oxybisbenzene					
1,4-Benzodioxin					
Benzene compound					
Benzenemethanol, .alpha.-methyl					
Tetrahydrofuran					
Dimethylnaphthalene compound				2	
1H-Indene compound				0.57	
Pentamethyl dihydroindene compound				2.6	
Propyl furan					
3-Methylphenol					
2-Methyl-pyridine					
Hexahydro-2h-azepin-2-one					
2-Ethyl-1-hexanol					
1,7-Dihydro-6h-purin-6-one					
(Chloromethyl)-oxirane					1.7
Fatty alcohol					

COMPOUNDS	111	11D	11S	11D	B-4	WU9-S
Total aliphatic hydrocarbons			0.013 B	0.28		
Total chlorinated hydrocarbons	62.2	0.344				
Total unknowns	0.57	2.45			6.1	
Total unknown hydrocarbons						
Chlorinated propene						
Chloropropene						
Chloropropane						
1-Propene						
3,3'-Oxybis-1-propene						
Phenol,4,4-(1-methylethylidene)bis						
Phenol, 2,6-Dichloro-						
n-Phenylacetamide						
Ethanone, 1-phenyl	0.31	0.022				
Ethanone,1,1-(1,3-phenylene)bis-						
Ethanone, 1,1-(1,4-phenylene)bis-						
Ethanone, 1-(4-(1-hydroxy-1-methylethyl)phenyl-						
Octanoic acid						
3,3-Thiobis-1-propene						
1,2-Dichloro-1-propene						
1,3-Dichloro-1-propene	1.2	0.014				
2,3-Dichloro-1-propene	0.18					
3,3-Dichloro-1-propene	0.28					
Chloromethylbenzene						
1,3,5-Trichlorobenzene		0.013				
1,1-oxybisbenzene						
1,4-Benzodioxin		0.012				
Benzene compound						
Benzenemethanol, .alpha.-methyl						
Tetrahydrofuran						
Dimethylnaphthalene compound						
1H-indene compound						
Pentamethyl dihydroindene compound						
Propyl furan					1.5	
3-Methylphenol	0.35					
2-Methyl-pyridine					12	
Hexahydro-2h-azepin-2-one						
2-Ethyl-1-hexanol						
1,7-Dihydro-8h-purin-8-one	1.4					
(Chloromethyl)-oxirane						
Fatty alcohol				0.12		

COMPOUNDS	HUS-4	HUS-5	HUS-7	001	002	004
Total aliphatic hydrocarbons						
Total chlorinated hydrocarbons						
Total unknowns			0.299	0.086	0.239	3.3
Total unknown hydrocarbons						
Chlorinated propene						
Chloropropene			0.04		0.03	
Chloropropene						
1-Propene			0.05		0.04	
3,3'-Oxybis-1-propene			0.01			
Phenol,4,4-(1-methylethylidene)bis						
Phenol, 2,6-Dichloro-						
n-Phenylacetamide						
Ethanone, 1-phenyl						
Ethanone,1,1-(1,3-phenylene)bis-						
Ethanone, 1,1-(1,4-phenylene)bis-						
Ethanone, 1-(4-(1-hydroxy-1-methylethyl)phenyl-						
Octanoic acid						
3,3-Thiobis-1-propene						
1,2-Dichloro-1-propene						
1,3-Dichloro-1-propene						
2,3-Dichloro-1-propene						
3,3-Dichloro-1-propene			0.014			
Chloromethylbenzene						
1,3,5-Trichlorobenzene						
1,1-oxybisbenzene						
1,4-Benzodioxin						
Benzene compound						
Benzenemethanol, .alpha.-methyl						
Tetrahydrofuran	0.01					
Dimethylnaphthalene compound						
1H-Indene compound						
Pentamethyl dihydroindene compound						
Propyl furan						
3-Methylphenol						
2-Methyl-pyridine						
Hexahydro-2h-azepin-2-one						
2-Ethyl-1-hexanol						
1,7-Dihydro-8h-purin-8-one						
(Chloromethyl)-oxirane						
Fatty alcohol						

COMPOUNDS	RRT-1(gh)	RRT-1(ds)	RRT-2	P/T
Total aliphatic hydrocarbons			0.013	
Total chlorinated hydrocarbons		0.51		
Total unknowns	7.25	2.84	0.035	0.02
Total unknown hydrocarbons	0.208	0.124		
Chlorinated propene				
Chloropropene				
Chloropropane				
1-Propene				
3,3'-Oxybis-1-propene				
Phenol,4,4-(1-methylethylidene)bis				
Phenol, 2,5-Dichloro-				
n-Phenylacetamide				
Ethanone, 1-phenyl				
Ethanone,1,1-(1,3-phenylene)bis-				
Ethanone, 1,1-(1,4-phenylene)bis-				
Ethanone, 1-(4-(1-hydroxy-1-methylethyl)phenyl-				
Octanoic acid				
3,3-Thiobis-1-propene				
1,2-Dichloro-1-propene				
1,3-Dichloro-1-propene				
2,3-Dichloro-1-propene				
3,3-Dichloro-1-propene				
Chloromethylbenzene				
1,3,5-Trichlorobenzene				
1,1-oxybisbenzene				
1,4-Benzodioxin				
Benzene compound				
Benzenemethanol, .alpha.-methyl				
Tetrahydrofuran				
Dimethylnaphthalene compound				
1H-Indene compound				
Pentamethyl dihydroindene compound				
Propyl furan				
3-Methylphenol				
2-Methyl-pyridine				
Hexahydro-2h-azepin-2-one		0.016	0.045	
2-Ethyl-1-hexanol				
1,7-Dihydro-6h-purin-6-one				
(Chloromethyl)-oxirane				
Fatty alcohol				

AR301359

APPENDIX U

RESULTS OF THE SYSTEM AND PERFORMANCE AUDIT OF LANCASTER LABORATORIES

System Audit of Lancaster Laboratories, Inc. in Conjunction with the RI/FS for the Tyson's Site.

A system audit of Lancaster Laboratories was performed on 9 October 1986 to evaluate laboratory procedures in association with the remedial investigation analyses for the Tyson's Site. Four subject areas were evaluated in the system audit, including:

- Sample Entry/Chain-of-Custody Procedures
- Sample Preparation
- QA/QC Procedures
- Equipment Maintenance

A brief description of the evaluation of each area is presented below.

Sample Entry/Chain-of-Custody

Sample entry is performed by Sample Administration (SA) personnel. Samples are received at the laboratory and delivered to SA where the sample is checked to the field chain-of-custody for discrepancies. A laboratory control number is generated by computer, and printed on an adhesive label along with pertinent information such as: analyses to be performed, special requirements, and storage location within the walk-in coolers. After samples are logged in, they are transferred by the SA personnel to the locked storage walk-in coolers with the chain-of-custody documentation. Only certain SA personnel have the required authority to access the locked storage coolers (sample custodians). Analysts needing samples must come to the authorized SA personnel who will then relinquish the required samples to the analyst on the chain-of-custody form. The chain-of-custody form is kept in possession with the samples until their return to SA. Sample entry and chain-of-custody procedures were in excellent order.

Sample Preparation

Organic and inorganic sample preparation is performed in separate locations and physically separated from the laboratory where the analyses are performed. Personnel were experienced in the required preparation methodology.

Holding times for sample extractions and analyses are monitored on a daily basis according to the collection date of the sample. Samples are routed to the sample preparation and analysis laboratories to meet the required holding times. Samples nearing the holding time and not yet analyzed or prepared are identified to the Environmental Division leader for corrective action.

QA/QC Procedures

Quality assurance procedures were being followed as specified by the individual analytical procedures. Analysts were familiar with the protocols and were responsible for update of the computer system with any quality assurance information generated by them. Quality assurance outliers are identified by the computer for corrective action when information is inputed. Quality assurance coordinators for each laboratory group are responsible for validation of analytical data and quality assurance data.

The laboratory Quality Assurance Coordinator reviews all quality assurance data generated by the individual laboratories. If significant trends are developing with a particular analysis, analyst, instrument, etc. a report is required to be submitted to the Quality Assurance Coordinator detailing the problem and the corrective action to be taken. Internal, blind quality assurance samples are routinely submitted into the laboratories by the Quality Assurance Coordinator as a further control measure.

Equipment Maintenance

A maintenance log for a GC/MS system was inspected. Problem descriptions were entered into a bound notebook with the date and signature of the investigator. Repairs and parts replaced or corrective action taken to correct instrumental problems were also described. Similar log books existed for other instrumentation. Parts that are commonly replaced are inventoried for the instrumentation to minimize down time.

Summary

The system audit did not reveal any problems in the performance of the laboratory. The organization and housekeeping was extremely impressive. Standard operating procedures were in existence for all laboratory functions, and all personnel encountered seemed knowledgeable and aware of their specific laboratory requirements.

Current state certifications are held in New Jersey, Pennsylvania, New York, Maryland, Virginia, West Virginia, and the laboratory is accredited by the American Association for Laboratory Accreditation (AALA).

PERFORMANCE AUDIT RESULTS FOR ANNUAL SAMPLES SUBMITTED TO LANCASTER LABORATORIES INC IN CONJUNCTION WITH THE RI/FS FOR THE TYSON'S SITE.

SAMPLE DESIGNATION	PARAMETER	SAMPLE #1 TRUE VALUE (ug/L)	95% CONFIDENCE INTERVAL (ug/L)	LANCASTER LAB RESULTS (ug/L)	SAMPLE #2 TRUE VALUE (ug/L)	95% CONFIDENCE INTERVAL (ug/L)	LANCASTER LAB RESULTS (ug/L)
WP 701 0 0	PESTICIDES						
	1,1-DICHLOROETHENE				20.0	97.7 - 86.5	48
	CHLOROFORM				40.0	80.0 - 68.3	91
	1,1,1-TRICHLOROETHANE				40.0	91.7 - 74.5	82
	BROMODICHLOROMETHANE				10.0	0.00 - 27.7	15
	TRANS-1,3-DICHLOROPROPENE*						6
	CIS-1,3-DICHLOROPROPENE*						9
	BROMOFORM				80.0	10.1 - 48.1	42
	TETRACHLOROETHENE				20.0	89.9 - 58.3	43

* - Dichloropropene were found to be unstable and produced 1,2 dichloropropane as a breakdown product. LL found 11 ug/l of 1,2 dichloropropane.

WP 601 0 0	ACID EXTRACTABLES						
	P-CHLORO-M-CRESOL				200.	101.0 - 267.0	200.
	2-NITROPHENOL				200.	117.0 - 419.0	230.
	PHENOL				200.	21.0 - 226.0	230
	2,4-DIMETHYLPHENOL				200.	59.0 - 181.0	120
	2,4-DICHLOROPHENOL				200.	122.0 - 211.0	120
	2,4,6-TRICHLOROPHENOL				200.	197.0 - 197.0	200
	4-CHLORO-3-METHYLPHENOL				200.	76.0 - 261.0	190
	2-NITRO-4,6-DINITROPHENOL				200.	314.0 -1199.0	200
	PENTACHLOROPHENOL				200.	136.0 - 949.0	200
	4-NITROPHENOL				200.	11.7 - 266.0	210

WP 602 0 0	BASE NEUTRAL EXTRACTABLES						
	BIS(2-CHLOROETHYL)ETHER	40.0	11.0 - 60.0	40.			
	1,3-DICHLOROBENZENE	80.0	7.70 - 66.2	80			
	1,4-DICHLOROBENZENE	80.7	9.60 - 59.4	80.			
	N-NITROSODI-N-DIPROPYLAMINE	80.0	3.03 - 62.8	80.			
	HEXACHLOROETHANE	79.7	40.1 - 143.4	80.			
	BIS(2-CHLOROISOPROPYL)ETHER	40.0	17.7 - 70.1	40.			
	1,2,4-TRICHLOROBENZENE	80.3	10.0 - 53.6	80.			
	NITROBENZENE	40.0	15.0 - 63.0	80.			
	P-CHLOROBENZOTRIFLUORIDE	80.4	15.0 - 63.0	80.			
	2,6-DINITROTOLUENE	78.8	47.3 - 107.7	80			
	2,4-DINITROTOLUENE	79.0	33.0 - 91.0	80			
	DIETHYL PHTHALATE	80.1	0 - 89.1	80			
	HEXACHLOROBENZENE	80.7	4.00 - 69.3	80.			
	PHENANTHRENE	40.2	33.0 - 49.0	40.			
	BIS-P-BUTYL PHTHALATE	84.0	2.10 - 28.6	80			
	PYRENE	80.3	36.7 - 86.1	80			
	BENZO(A)ANTHRACENE	79.9	31.0 - 97.0	40			
	BIS-B-BUTYL PHTHALATE	43.0	0.15 - 59.1	40			
	BENZO(B)FLUORANTHENE	69.7	9.00 - 96.0	80			

WP 603 0 0	BASE NEUTRAL EXTRACTABLES				201.	78.7 - 207.0	170
	3,4-DICHLOROBENZENE				200.	101.0 - 213.0	150
	BIS(2-CHLOROISOPROPYL)ETHER				200.	143.0 - 303.0	210
	HEXACHLOROETHANE				200.	101.0 - 303.0	150
	NITROBENZENE				200.	70.0 - 303.0	190
	NAPTHALENE				200.	0 - 464.0	150
	DIMETHYLPHTHALATE				200.	0 - 464.0	150
	ACENAPTHYLENE				197.	111.0 - 267.0	190
	FLUORENE				200.	169.0 - 264.0	200
	4-CHLOROPHENYL PHENYL ETHER				200.	137.0 - 264.0	200
	4-BROMOPHENYL PHENYL ETHER				203.	139.0 - 267.0	200
	ANTHRACENE				200.	78.0 - 245.0	110
	FLUORANTHENE				201.	109.0 - 268.0	240
	BUTYL BENZYL PHTHALATE				200.	0 - 230.0	170
	CHRYSENE				209.	63.0 - 230.0	60
	BIS(2-ETHYLHEXYL)PHTHALATE				193.	34.5 - 230.5	100
	BENZO(B)FLUORANTHENE				205.	76.0 - 207.0	170
	BENZO(A)PYRENE				204.	69.5 - 223.1	140
	DIBENZO(A,H)ANTHRACENE				204.	0 - 483.2	200
	BENZO(G,H,I)PERYLENE				205.	0 - 501.2	200

WP 1104	PCB 1242	50.0	34.0-68.0	47.0			
WP 670 - 1	PCB 1016	5.28	3.05-7.59	6.0			
WP 670 - 2	PCB 1016	1.31	0.84-1.76	2.1			
WP 670 - 3	PCB 1221	7.20	3.86-9.72	8.0			
WP 670 - 4	PCB 1221	1.36	0.86-1.70	1.4			
WP 670 - 5	PCB 1232	6.39	3.64-8.78	6.0			
WP 670 - 6	PCB 1232	1.43	0.86-1.91	1.0			
WP 670 - 9	PCB 1248	9.10	3.17-10.9	7.0			
WP 670 - 10	PCB 1248	1.91	1.37-2.53	2.7			
WP 670 - 13	PCB 1260	8.80	3.56-13.4	7.3			
WP 670 - 14	PCB 1260	2.76	1.46-3.72	2.6			
WP 702 - 17	PCB 1254	9.40	2.10-7.30	5.0			
WP 702 - 18	PCB 1254	1.82	0.83-2.19	1.9			

WP 105	Alpha BHC (Unstable, but present)			0.0			
	Beta BHC	2.0	0.76-3.62	1.8			
	Heptachlor Epoxide	2.0	1.13-3.63	2.1			
	Endosulfan I	2.0	1.14-3.02	2.0			
	Endosulfan II	10.0	2.2-17.7	9.7			
	Endrin Aldehyde	10.0	1.15-11.6	9.0			

WP 305	Heptachlor	2.0	1.06-3.34	1.7			
	Aldrin	2.0	0.84-3.80	1.7			
	BHC	2.0	1.06-3.60	1.8			
	Dieldrin	2.0	1.15-3.49	1.9			
	DDE	10.0	4.9 -31.6	9.1			
	DDT	10.0	4.6 -31.7	10.1			

WP 1106	Chlordane	49.0	25.6-81.9	50.0			

	Aluminum	200	429-633	540			
WP 304	Arsenic	100	77.8-131	99			
Metals I	Beryllium	100	86.1-113	98			
	Cadmium	93	19.0-37.7	23			
	Chromium	100	77.7-119	90			
	Cobalt	100	85.9-113	100			
	Copper	100	87.0-119	100			
	Iron	100	83.3-119	90			
	Lead	100	85.0-118	93			
	Manganese	100	87.0-111	90			
	Mercury	1	2.30-6.19	4.9			
	Nickel	100	86.1-118	100			
	Selenium	11	19.0-31.2	19			
	Vanadium	200	213-299	200			
	Zinc	100	83.0-118	100			

WP 1103	Antimony				101.0	64.1-138.1	81.
Metals II	Silver				4.97	3.78-6.96	<10
	Thallium				8.88	3.59-10.1	<10

WP 1109	Barium				1560	8488-1149	1160
Metals III							